The Builder.

VOL. XLI. No. 1966. SATURDAY, FEBRUARY 26, 1881.

ILLUSTRATIONS.

Homefield, Merton: Alterations and New Wing.—Mr. Alfred Jowers, Architect 244
A Design for the Proposed Liverpool School of Art (Plans, 251).—By Mr. Edward A. Heffer, Architect 245
The Church of San Estéban, Salamanca: A.D. 1524 to 1610 (Double-page Engraving) 248
The Drawing-room, Homefield, Merton 253

CONTENTS.

Building in Germany 233
Sanitary Discussions at the Institute 234
Royal Academy Lectures on Architecture, 1881. By Professor G. E. Street, R.A. 235
The Parthenon: Its Architecture and History: The Chryselephantine Statue of Athene 239
The Great Discoveries at Olympia 240
Death in the Air 241
The Late Mr. E. H. Carson, Architect 241
St. Mark's Venice, and the Accademia di San Luca 242
Homefield, Merton 242
Liverpool Institute: A Design for the New School of Art 242
The Church of San Estéban, Salamanca 242
An Excursion in Lombardy: Architectural Association 255
Lectures at the Parkes Museum of Hygiene: Water-closets, Sinks, and Baths 255
Sanitary Science in its Relation to Civil Architecture 256
Warming by Radiation, with Cold Air for Breathing 258
A Case of Dry Rot 259
Builders' Clerks' Benevolent Institution 259
City Stations 259
"Persian Plan-Drawing" 259
The Drainage of Mining Towns 259
Boiler Explosions 260
Competitions 260
Snow Thawing by Steam 260
Case under Metropolitan Building Act: Shop Fronts 260
Books: Law's Rudiments of Civil Engineering; Variorum 260
The Lincoln Master Builders' Association 260
Miscellanea 260

Building in Germany.

IT would be difficult to point to a case in modern times which could more satisfactorily prove the truth of the saying, in all its acceptation, of the old French mason-member of Parliament, M. Nadaud, that "when the building trade prospers, everything is going on well," than the present condition presented by the large towns of Germany. All our professional readers are aware of the extraordinary building mania which took possession of the Germans immediately after the Franco-Prussian war, the result of the enormous influx of capital into the country by the unexpectedly speedy payment of what was innocently thought to be the crushing indemnity demanded by the conquerors. The effect of this mania is visible to the traveller in the larger cities of the German empire.

There are few more depressing sights than lines of ghastly buildings long since commenced and neglected, their rude beginnings already suffering from the effects of time; there are few spectacles more suggestive of melancholy reflection than the appearance of neighbourhoods of apparently grandiose mansions sparely tenanted, the rare vehicles, the solitary passers-by, the uncurtained windows, the glaring bills, the general aspect of deadly-liveliness. Many, —most,—of the more modern towns of Germany offer a succession of such scenes, for the wild prosperity that succeeded the war influenced every corner of the empire; it lasted, however, but a very short time, and the imagined source of wealth suddenly dried up from a multitude of causes not difficult, but somewhat too lengthy, to enumerate. It required but a very insufficient acquaintance, not with the principles of political economy, but with human nature, to understand how such an outburst of excitement would end. The frugal Germans were unable to withstand the golden flood that to them seemed inexhaustible; but employed as the French money was, to supply the needs of a vast military department, to feed a crowd of base speculators, even two hundred millions sterling were rapidly disposed of without adequate return and with the most disastrous consequences.

We were informed the other day by one of those many intelligent Germans who fascinate the Englishman by their general information, that if we wished to obtain a trustworthy account of the strange period which in Germany succeeded the war, we should find it well described in the work with which M. Tissot made, some four or five years since, a reputation, his "Voyage au Pays des Milliards." On referring to that amusing and instructive book, among many other matters relating to Germany, in the chapter devoted to the Bourse of Berlin we lighted on some suggestive details relating to the building mania of the excited twelve short months that succeeded the arrival of the French gold in Prussia. It would be difficult to sketch in a more rapid manner the character of the period than in the following paragraph:— "These five milliards (200,000,000*l.*) falling into the helmet of Prince Bismarck like the last lay of the goose with the golden eggs, turned the heads of every German. At Berlin, the days of classic mythology returned, and the Spree,—new Pactolus, so it was imagined,—was to roll in its muddy waters untold gold; money was to be had for the mere picking of it up. The hallucination lasted a year. Companies started from the ground like mushrooms after the rain, and everything was turned into shares; the humble businesses of the butcher, the grocer, and the beershops; streets, canals, and roads. Houses were sold at the Bourse, and in two hours passed through the hands of five or six owners. In eight months the price of real estate doubled; a five-storied house was sold for 40,000*l.* or 50,000*l.* Lodgings were quoted like the stocks; fifty to sixty persons would bid up a garret. In 1872 there were no fewer than from fifty-two to sixty-five persons to every house (the houses in Berlin, it must be remembered, are usually only three to four stories high), that is, about ten persons to every room. The bricklayers amassed fortunes, worked ten hours a-day, drank champagne in beer-mugs, and went from their work to the restaurant in cabs; a hod-carrier gained his five thalers (fifteen shillings) a day; bank-clerks, without place and without shoes or stockings to-day, to-morrow paraded in white kid gloves in the front box of the theatre. At the distant rumble of the wagons full of gold from the Bank of France the soil trembled and opened like a trap in a pantomime; beer-houses huge as palaces arose,—restaurants more grandiose than cathedrals,—enchanting gardens, in which the perfume of flowers and the sounds of music were mingled,—in the winter, in the warm and voluptuous atmosphere of vast conservatories; in summer, by refreshing cascades and glistening fountains."

Places of amusement were necessary for a people who, like the Romans after the provinces had been conquered, clamoured for "bread and circuses." The Kaiser Gallerie was built; the Kaiser Gallerie is now deserted; the huge establishment of the Flora, a place unique of its kind, with its dining-room for 2,000 people and a ball-room opening on to a conservatory stocked with palms and rose-bushes, is closed. Rival companies bought up the feudal châteaux in the neighbourhood of Berlin, to transform them into summer palaces, with lakes and pleasure-yachts, with artificial mountains, and what not; but, as remarks M. Tissot, this vision of the Thousand and One Nights did not last a year. The whole of Germany,—"that nation of thinkers," as its philosophers have called it,—allowed itself to be deceived by a mirage.

Throughout Germany the scene that the French author has described at Berlin was imitated on a proportionate scale, and with the same sad results. Each great city can show the new neighbourhoods which were built up under the influence of the excitement which was carrying away the capital, and each city shows these same neighbourhoods ill-occupied, and yielding no return for the outlay. The German is of a very different character to his old enemy, the Frenchman; modern notions of style ill-suit his nature, nurtured amidst the primitive traditions of the past. It is not the gorgeous halls of the modern *cafés*, decorated with their brilliant wall-paintings, with carvings and gildings, with columns, festoons, and mirrors,—it is the old-fashioned and more homely, comfortable, *café* or beer-house he still retains his affection for.

Here it was that the knowledge of human nature and the needs of the day were wanting to the builders of the period that succeeded the war. The German loves Paris, but at Paris, and not at home; and here a valuable lesson may be learned from the result of our German neighbours' building craze. An intelligence and understanding of the needs of the day and of the people are absolutely necessary to the builder; these needs he should constantly strive to keep before him, changing and progressing as they so constantly are; he should, in fact, be prepared to meet in practical spirit the constantly recurring "manias," as they are somewhat irreverently termed. It is in accordance with the condition of the fluctuating prosperity of commerce that the building trade is more or less active; building is one of the first directions in which accumulated capital can be most wisely expended; so much has this at all times been known to be the case, that the degree of prosperity of a country can be very satisfactorily judged by the state of its building trade, a test as equally applicable to a judgment of the past as of the present.

Throughout England such a test would infallibly show the growing prosperity during centuries of our "nice little, tight little island," in spite of the momentary lapses and struggles that the building trade at all times is inevitably subject to, from its natural and entire dependence on the state of contemporary prosperity. America offers the traveller startling instances of the infallibility of the test in the magic manner in which city after city is built up, enlarged, or rebuilt. On the first move abroad it is impossible to pass through the comfortable Belgian towns which the prosperity of centuries has built up, and is still improving and enlarging, without being struck by the correctness of the standard, as noticeable in smiling France as in

industrious Belgium or wealthy Holland. Where more than in Italy is the tale so clearly told of the period of prosperity of each of the cities that one passes through from north to south? One needs no knowledge of history; no hint from guide-book, in matters such as these. And the same is the case with the old towns of Germany, built up during the prosperous days when, if, as according to the proverb, the power of Venice was almighty, the wealth of Augsburg, the cannon of Strasburg, the wit of Nuremberg, and the gold of Ulm ruled the world,—old towns which speak of the days when the enormous trade between the East and the West flowed through their gates, when the Cape of Good Hope was still roamed over by untutored Zulus, and America lay buried in its lovely autumnal mists far below the horizon of the timid European navigators; old towns to which, since the discovery of the great continent and the new route eastwards, little has been added,—and why? Because from that moment their tprosperity declined, and, natural consequence, heir building trade fell off. Increase of population has naturally rendered great alterations necessary, such as are inevitable in the passage of time, the advent of new manners, the demands requisite on new needs, but the doubtful state of prosperity warranted no serious outlay, no great movement, in this direction.

After a long period of repose, forced repose, the sad result of wars innumerable and desolation universal, on Germany,—almost as much as Belgium the cock-pit of Europe for more than two centuries,—the effect of the great success over France, whereby millions upon millions poured over the frontier into a thrifty country where frugality had become from long habit and necessity second nature, was fatal. Germany is suffering, strange paradox, from its success, while the prosperity of its rival is a matter of daily surprise to every student of the old-fashioned principles of political economy, and in no feature is the prosperity of France more completely shown than in the unprecedented activity of her building-trade; again it is seen that "when the building-trade is prosperous all goes well."

It is somewhat saddening to consider the terrible crisis from which Germany is now suffering, a crisis the result of her own improvident and thoughtless expenditure, and the end of which the wisest heads are incapable of seeing; commerce is in a fatally languishing condition and complaint general. The lessening of salaries is looked upon as the sole means of safety. It is some years since Herr Camphausen, Minister of Finances, uttered the memorable words, "Germany must produce her manufactures at a cheaper rate if she does not wish to remain longer tributary to foreigners. We must become more thrifty, economical, and laborious, but, before all, the important question of salaries must be regulated; we must require more work from the workman and we must pay less for it." During the several years that have succeeded this advice, in so many particulars carried out, for few people work more cheaply or understand thrift better than the Germans,—the crisis cannot be said to have advanced in any appreciable manner nearer its close. As a natural consequence of this absence of prosperity, the building-trade has suffered cruelly; with the exception of certain large works in the great cities the stagnation that has succeeded the mania has grown more desperate each year.*

There has been no period of modern history when the larger cities of Europe and America have not been subject to such building manias as that of Germany a few years back, all of which have left more or less their mark, and have effected their purpose of usefulness for succeeding generations. It would not be a difficult task to enumerate these periods; in London, for instance, there have been, within the memory of old, experienced builders and architects, many such epochs; and it is in accordance with the fluctuating character of commercial prosperity that it should be so.

Building is, as we have said, one of the first means that we have of well bestowing our accumulated capital, but in so doing the utmost care must be taken in the way in which we build, and no worthier principle could be followed, than that held out in the motto that we have so long quoted on our title-page,—"Every man's proper mansion-house and home, being the theater of his hospitality, the seate of selfe-fruition, the comfortablest part of his own life, the noblest of his sonne's inheritance, a kinde of private princedom, nay, to the possessors thereof, an epitome of the whole world, may well deserve by these attributes, according to the degree of the master, to be decently and delightfully adorned." Having built with such views before us, and with every consideration to those modern well-thought-out sanitary appliances so necessary to be adopted, we shall then have expended our capital in a wise and beneficial manner, subject to no unjust or ruinous fluctuations.

The land should be the builder's own.

* Among the most recent of these works, many of them of great importance, the "Reichajustizamts-gebäude" at Berlin certainly deserves mention. It must be considered no demerit in this work that it should recall Sansovino's beautiful Library of St. Mark, which has inspired in an almost equally happy manner the design of the superb New Academy of Fine Arts at Munich (not yet completed).

SANITARY DISCUSSIONS AT THE INSTITUTE.

The paper recently read at the Institute, and the discussions which have followed, have included the expression of a considerable variety of opinions, and it may be worth while to note some of the points of agreement and contradiction. Of the latter there has been a good deal; and persons who should take up the report of the discussions with the view of arriving at some definite opinion on the points treated of would find themselves in the difficulty of decision proverbially incident upon the disagreement of doctors.

It is satisfactory to find that an independent authority on sanitation, Dr. Corfield, who was invited to lead the discussion, bore testimony to the ability and willingness to deal with the subject which he had found on the part of architects when he had been called upon to confer with them about it. It should be unnecessary to have such a testimony; that it is necessary is due partly to the fact that there are architects who are very neglectful of this portion of their duties, and partly to the prejudices of the public and of newspaper critics, who will not take the trouble to discriminate; who find one day an architect neglectful of sanitation, and immediately jump at the conclusion, and do not hesitate to publish it, that all architects are neglectful of sanitation. While on this point it may be observed also that remarks in the course of the discussion tended to show, what some of us know, that the subject of sanitary measures has occupied a portion of the profession at least for much longer time back than many of the modern apostles of the subject are aware of. Sanitation is now rapidly becoming what may be called a popular subject, and a good many people who have taken up a new interest in it are apt to imagine that it is as new to every one else as it is to them,—a remark which again, we fear, must be said to apply in an especial manner to the contributors to the daily press of this country. A smart writer learns a new thing or two about sanitary matters, and forthwith writes a leader declaiming on the ignorance and backwardness of the architectural profession, thinking, illogically, that their information (if he credits them with having it at all) is as recent as his own.

The points on which there seems to have been most divergence of opinion are those connected with warming and ventilation, and their influence one upon another. It was, indeed, propounded by one speaker, Professor Ayrton, that warming and ventilation ought to be regarded and practically treated as two different subjects. It is, no doubt, possible to consider the mechanism of warming and of ventilation separately to a considerable extent, but it is impossible to regard the two subjects as entirely apart from one another. Natural laws will not allow us to do so. Any means of warming an apartment must and will influence the movement of the air, which means the ventilation, and its effect in that respect must be considered. Mr. Ewan Christian appeared in the debate as the upholder of the good old school. He did not believe in many of the schemes propounded for ventilation; "the best plan was a good open window and a fire roaring." This, we presume, we may take as a joke, though it appears as deliberately recorded in the official report of the Transactions. Mr. Christian's statement that people will not tolerate ventilation holes, and that they were constantly stopped up, received corroborative evidence, indirectly, from other speakers, and we do not question its truth, but we do not see that on that account all the science of ventilation "goes for nothing." Mr. Spencer Rolfe made a remark very much to the point in regard to this, as to the fancies of many people who could not see a ventilation inlet of any kind without immediately imagining that they felt a draught; and consequently if they had any control over the opening they would immediately close it. It is an unfortunate fact, arising perhaps from our long neglect of the subject, that there are a large number of people who have a horror of being ventilated. The feeling exists almost universally among the poor, as is well known, but it is very common among those who ought to know better, or who have perhaps acquired, through the life-long habitation of unventilated rooms, a genuine sensitiveness to the effect of fresh air, which they never would have acquired if they had inhabited well-ventilated houses all their lives. It cannot, however, be supposed that on this account we can expect to be allowed to apply to private houses ventilation which is beyond the control of the inmates. That would be a too paternal government. Moreover, draughts must be prevented. Bad air is quietly deleterious, but a draught may be actually deadly. In all public rooms, where the ventilation is designed to promote the greatest happiness of the greatest number, the ventilation system should be incapable of control other than official. But in private houses, we must allow people to cut off fresh air from themselves if they choose to do so. We can only educate them on the subject until they know better.

The subject of the admission of fresh air to rooms divides itself into two questions,—the means taken to induce the inward current, and the place where it should be introduced. The means are two,—mechanical propulsion, and indraught by the difference of density produced by greater heat within. Propulsion will hardly ever be applied to private houses, except such as are on a large scale, and kept up regardless of expense. For large public rooms, where expenditure is not so much a consideration, propulsion appears preferable, as it gives complete control, and by placing the air slightly in compression, effectually prevents in-draughts from any other than the contrived inlet, before entering which the air may be warmed in winter.

There is also the system of compelling the influx of fresh air by mechanical extraction of the foul air, which, to a certain extent, may be regarded as propulsion in a modified form. This has the disadvantage of losing the absolute control over the point of influx, and leaving the apartment exposed to possible draughts. Where mechanical means are used at all, we are, therefore, decidedly in favour of propulsion. In private houses, where only what may be called natural ventilation, or movement of air by balance of pressures, can be generally available, the question is where to admit the air. On this point the conclusions of the discussionists at the Institute seem absolutely to neutralise each other. One is in favour of vertical tube inlets, another thinks them altogether bad. One would admit the air at the top of the room, another in the middle. There has been such a general run in favour of vertical tube inlets lately that we were somewhat surprised to find them very roughly handled by more than one speaker, we do not say without reason. It is one instance of the way in which these things are taken up by the mere force of fashion, without any consideration, that since Mr. Tobin revived this vertical tube system, and, as one speaker remarked, succeeded in reaching the ear of the public when others had failed to do so, there has been a general conviction that you have nothing to do but put vertical tubes at the sides of your rooms, and you are all right. It is as well that people should be checked in this sort of unthinking way of taking up a system, and induced to consider for a moment what its effects really are, or whether they are equally beneficial under all circumstances. The defects alleged against the vertical tubes in the course of the discussion were that, on a cold day, and with a fire burning, the air took pretty nearly the straightest course to the fire, causing draughts that were disagreeably felt; or that, under other circumstances, the cold air, in ascending to the top of the room in the first instance, became partially mixed with impure air there, and in its inevitable descent brought down with it some of the impure air to be breathed again. One speaker, in the discussion, asked if it were not eminently bad and unscientific to thrust columns of cold air up to the ceiling, with the

view of purifying the atmosphere of the room; though he certainly expressed himself inaccurately in saying that "this air" was brought down again to the level of the lungs, "to be breathed again by the persons who had expired it." That air which comes through the tubes has not been breathed before, but it certainly may, as we have said, bring down with it some that has. Our conclusion would be that the vertical tube system was a bad one for winter, when there is a fire and when the air entering through the tubes is much lower in temperature than the air in the room, and that it must in all probability produce draughts towards the fire; but that in summer it may be used with advantage, when there will not only be no draught towards the fireplace, but when the indraught will be less rapid, owing to the greater similarity of the internal and external temperature, and the cold air will not be brought in with a rush such as would carry it up towards the ceiling, but would diffuse itself quietly and without draught. The best method of inlet for cold weather (and the general sense of the meeting seems to have been in favour of it) we consider to be the drawing in of warmed air through a warm chamber behind the fireplace, admitting it into the room about 5 ft. or 6 ft. from the ground. The vertical tubes might be placed as an alternative ventilation for temperatures in which they would act better than the ingress behind the fireplace, and could be stopped when not used. We confess, however, that the result on our own minds of the consideration of the subject, coupled with some of the statements made in the course of the discussion, has been to reduce the credit of the vertical tube system considerably.

There can be no doubt at all that the exit for the vitiated air, when the ventilation is not governed by special mechanical means, should be at the top of the room. To that part of the room it naturally ascends, and thence it should not be tempted to descend again. The fire necessarily draws part of the air of the room, but there is no reason why it should draw the vitiated air, and for that very reason the ingress of the fresh air in a tolerably near neighbourhood to the fire, so that the latter may get its supply without drawing down again the air that has been used, seems desirable. An ascending extract-flue, contiguous to the chimney-flue, so as to be well warmed by it when the fire is used, and capable of being warmed by a gas-jet when the fire is not in use, seems the best principle; the opening into the said flue to be from the upper part of the room.

Nothing would contribute more to the comfort of dwelling-rooms in cold weather than more attention to the warming of the hall and staircase, which is usually a reservoir of cold air constantly liable to be drawn into the rooms; and the suggestion of Dr. Thompson, referred to by Mr. Robins, that water-closets should be kept at a higher temperature than the passages leading to them, and, of course, with a separate means of extract, is an obvious precaution which it would be most desirable, though, perhaps, not always easy to carry out. Usually the case is the reverse, and consequently there is a current of foul air inward into the house. It is curious that in speaking of the admission and extraction of air, those who took part in the discussion seem to have allowed themselves to lose sight of the well-known fact that extraction cannot be performed with any certainty by numerous outlets,—that practically there is almost always one outlet, and that various outlets are very apt to become mere passages for cross draughts from one to another. One speaker in the discussion wanted to have the bad air, after it had been mixed with the incoming draught from vertical tubes, carried away by an exit about 6 ft. or 7 ft. from the floor, to catch it, apparently, before it got down low enough to be breathed again,—as if air would go just where one liked for mere wishing.

In regard to the question of warming, we may observe that Professor Ayrton's open fireplace retained in form, "but the radiating surface of incandescent coal replaced by a larger radiating surface of pipes, heated by water and steam," is a very comfortless-looking substitute for a fire, and that it is quite possible to combine the two,—to have the incandescent fire in a more economical form, and to have radiating surfaces of pipes, or tubes, in combination with it, and catching and utilising what would otherwise be waste heat from the fire, as in the *Cheminée Cordier*, which we mentioned in reviewing, the other day, M. Planat's large work on "Chauffage et Ventilation." Another point we may touch upon in the discussion is that a check was given to the sudden raid against water-traps which seems to have set in, by the assurance of Professor Corfield that such a trap was a necessary adjunct of overflow and waste pipes even discharging "into the open." The pipes,—especially scullery waste-pipes,—become often coated with putrescent matter, which fouls the air that passes through the pipes into the house. Some people seem to think that, because a trap has been found to be an inefficient check to sewer-gas under pressure, it is therefore a contrivance positively injurious and useless, which by no means follows.

Considering the vital importance attached to proper sanitary conditions now by those who have any knowledge of the subject, it is not surprising to hear opponents inquiring how people lived in days when none of the contrivances now considered so all-important were known or thought of, and when the majority of people inhabited houses all of which would now be pronounced by a sanitary authority as "unfit for human habitation." The probability is that, after all, a large number of constitutions, especially of those who get a good deal of outdoor movement and change of place, are robust enough to live in spite of very disadvantageous conditions. The precautions have to be taken in the interest of the percentage who are not so fortunately constituted, and would consequently be killed off before their time. As comparing the present with the past, however, towns are much larger and more crowded now, and the difficulty of guarding against pollution of air, earth, and water proportionably greater. But even apart from that, we imagine that with the progress of material civilisation there is a progressive and inherited sensitiveness in regard to unhealthy conditions. This was alluded to by Professor Ayrton, in mentioning the manner in which in some other countries people apparently enjoyed health under conditions which would be intolerable to us, and he made the suggestion whether there might not now exist in this country conditions which in some future time would be considered unhealthy, but which we had no sense of at present. He is probably right. We contrive and adapt in reference to our own present perceptions, and in the very act of doing so probably prepare the way for the cultivation of new and more sensitive perceptions in future generations, who will have in their turn to create new and more stringent sanitary regulations.

ROYAL ACADEMY LECTURES ON ARCHITECTURE, 1881.*

BY PROFESSOR G. E. STREET, R.A.

The Principles of the Art.

IN my last lecture I endeavoured,—and, I hope, not in vain,—to show you what course you ought to take in pursuing the study of architecture as a fine art. I assumed that you were all students, whether of my own branch of art or of others, and that you would all, if you really aimed at success, gladly welcome my advice, even if at times I seemed to demand very much from you in the way of imagination, of zeal, of enthusiasm, and, more than all, of industry. To-night I advance a step further in an attempt to show you what are the principles of the art to which some of you are devoting yourselves, and in which all of you are interested.

Few, I suppose, can doubt that there are true and false principles in all the arts; but that they are more capable of definition in regard to architecture than to any of the others, is certain,—and this because the absolute truth or falsehood of an architectural work is capable of demonstration up to a certain point. But by *principles* you must well understand that I do not mean *rules*. These last have often been laid down, with the result that where they have been obeyed implicitly, all life has been most effectually stamped out. Such, *e.g.*, is the supposed rule of proportion of columns and their entablatures of Greek and Roman temples. This was derived from the measurement of some one example, and the establishment of that as the model for all others; so that, given the diameter of your column, the rest followed, and, in short, the rule was not one for designing a good column, but one for copying exactly a particular column. There is no pretence for believing that such rules ever affected the original architects; and the particular features to which they are applied are so different in their proportions in ancient examples, as to prove that, even in the best days, there was great latitude allowed, and that there was none of the insipidity which is the certain consequence of obedience to such arbitrary rules. If you want to know how far the framers of such rules may try to take you, a few quotations from Scamozzi's "Mirror of Architecture" will suffice. "Here," he says, "is shown how the columns follow one another, and how high every one must be." "The Doric must be twelve models and fifty-three minutes and a half high." "The Ionic must be thirteen models high." "The Tuscan arch must be three models and fifty-two minutes wide." "The impost is twenty-seven minutes high," and so on, down to every detail of the column, its capital and base, pedestal and impost. Everything "must be" of an exact and defined height, projection, or distance apart.

The principles of the art of architecture are as eternal and reasonable as the so-called "rules" are arbitrary and ephemeral. It is with the former only that we are concerned to-night. The most indisputable are those which affect construction, and they are of universal application. The construction of a building must be good if it is to be a work deserving of our respect; and by goodness we understand that it must be (i.) permanent; (ii.) exhibited rather than concealed; (iii.) natural; (iv.) suitable to its purpose and material; and (v.) it must avail itself of the latest discoveries and inventions where it is clear that they are usable under or consistently with the first four conditions.

A few words only will be necessary on each of these divisions. (i.) *Construction must be permanent.* In my last lecture I told you that our respect for old architects was generally in exact proportion to their respect for themselves and their work. No architect would willingly, I suppose, build a wall that was certain to fall; but he is hardly less to blame who knowingly builds one that is sure not to last very long,—who makes it too thin, builds it without sufficient foundations, or uses a bad quality or insufficient quantity of mortar or cement. And as it is certain that purely temporary building is not architecture at all, so that is most likely to be architectural which is made to last as it were for ever. Now, to be permanent, a wall must be well constructed. It must not only have good and solid foundations, but its weights must be evenly adjusted and duly provided for, and its various openings must be, as far as possible, no cause of weakness to it. But, according to the second principle, that construction should be exhibited rather than concealed, the coverings of these openings ought to be evident and obviously strong enough for their place. A lintel is a good thing to use if you can be quite sure that it is strong enough not to break in two, but it is not a good thing if it really does no work, but is relieved of all weight by a hidden lintel of iron, or by an arch concealed in the wall above it. So, also, in good work, the construction of the exterior should, as far as possible, show the arrangement of the interior, and you ought at once to know something about the positions of the floors, the shape of the roofs, and the sizes and uses of the principal rooms, merely by examining the exterior of a building. The next principle that I have laid down is that the design must always be natural, that is, proper to the place, as simple as the case allows, and not strained or eccentric in its character or detail for the mere sake of producing effect. And on this point I cannot do better than by quoting what Leon Battista Alberti has well said (book i., chap. ix.):—

"We ought not to lay out our whole study in adorning one part of our building, so as to leave the rest neglected and homely in comparison of it; but let them bear that proportion among themselves that they may appear to be an entire and perfect body, and not disjointed and unfinished members. Moreover, in the forming of these members we ought to imitate the modesty of nature. Let the members, therefore, be modestly proportioned and necessary for your uses. For all building, if you consider it well, owes its birth to necessity, was nursed by convenience, and embellished by use. Pleasure was the last thing consulted in it, which is never truly obtained by things that are immoderate. Let your building, therefore, be such that it may not want any members which it has not, and that those which it has may not in any respect deserve to be condemned. Nor would I have an edifice terminated with even continued lines void of all manner of variety. Variety is, without dispute, a very great beauty in everything when it joins and brings things together in a regular manner,—things different but proportionable to each other. For, as in music, when the bass answers the treble and the tenor agrees with both, there arises from that

* Second lecture, delivered on Thursday, Feb. 17. (For first lecture, see p. 202, *ante*.)

variety of sounds an harmonising whole; so the like happens in everything else. Of course, things must be executed according to the approved practice of men of skill; but with this caution, that when famous architects seem by their practice to have determined this or that treatment of Doric, Ionic, Composite, or Tuscan, to be the most beautiful of any, yet they do not tie us down to follow them so closely as to transcribe their very designs; but only stir us up by their instructions to produce something of our own invention, and to endeavour to acquire equal or greater praise even than they did."

The natural treatment of the general design of a building is, therefore, that which you should always aim at, providing for the requirements of the building without any violent sacrifice for the sake of mere architectural effect. But such a principle as this has, of course, its limits. There is a sort of scenic effect which is not to be obtained so easily in any other way as by elaborately symmetrical arrangements of plan and building. Few finer examples of this can be pointed to than Greenwich Hospital, where,—save for the blank absence of any central object to which the rest may lead up,—the effect is unquestionably stately and impressive in a very high degree. Another example of the same class is Bernini's really grand quadrupled curved colonnade leading up with a vast sweep to the front of St. Peter's at Rome. Its scale is grand, and its extent magnificent; but it overwhelms the building to which it leads, and, grand as the idea is, the effect is not perfect, solely, as at Greenwich, because the central object is not in itself worthy of such a noble approach. In the late Genoese palaces you will find good illustrations of the same sort of scenic architecture dependent for its effect on stately arcades leading from terrace to terrace, and in many of the French and English houses of the Renaissance there are somewhat similar arrangements. One wing corresponds with another; there is a central porch; and the garden is arranged in regular terraces, with pavilions or summer-houses at proper intervals. But if you compare one of the finer buildings of this class,—as, for instance, Montacute House or Barrington Court,—with the design of, say, Haddon Hall or Magdalene College, Oxford, where every portion of the building tells its own story, and is differently treated accordingly, it is impossible to deny that the love of stately balance and symmetry may be satisfied at too great a cost, and that a far better artist is generally revealed in the least formal work of the two. However much one may appreciate scenic architecture, it is necessary here to be rather discouraging as to its common introduction. For a long time the student has been taught that the only possible good arrangement of a large building is one founded on this principle. It has been assumed that all buildings must have a centre and wings corresponding exactly. If the stables are built in the guise of a wing connected with the mansion by a colonnade, then some use must be found, at all risks, for a corresponding colonnade and wing on the opposite side. So, a chapel and kitchen having to balance each other, neither can be allowed to tell its true story on its face, and, in the end, the scenic effect is the one thing that seems to be thought of. This is not convenient building, and is consequently not good art, and the cases in which it can be ventured on must always be rare and exceptional in their opportunities.

The next rule is that the design should be suitable for the material which has to be used. This is a practical rule which involves the wise adjustment of the means to the end. No architect should ever quarrel with his materials as long as he can ensure their being the best of their kind. His sole business is to take care that his design is suitable to the material, and usually to that which is nearest to his hand. Where means are unlimited, or the object to be attained is one of monumental character, then it is right to go far afield at any cost to obtain the best and most magnificent material; for the first step to be taken, if a building is to be sumptuous, is that the material should be worthy of the labour that is to be expended on it. And to some extent the material that is to be used settles the design of the work. A quarry which produces enormous blocks of granite has scant justice done to it if the architect who uses it confines himself to small blocks of stone. It leads almost naturally to the use of great monoliths, than which nothing is more impressive, though there may be no art in the mere magnificence of size. Again, a design suitable for a stone country would be wholly unfit for one in which brick alone could be used; and wherever many marbles could be obtained, the design, to be natural, must be in every respect quite unlike anything that could be built in a country where nothing but a fine and easily-worked oolite existed, or in one where the only material was a hard and untractable limestone. Natural use of his material is, indeed, one of the first aims of a good architect, and this not only in the selection of the stone to begin with, but equally in the way in which it is worked. If you use a fine marble for the face of a wall, it must be wrought very finely everywhere, and polished for the best part of the work. If, on the other hand, you use a freestone, you may confine yourself to working the elaborated architectural features, only leaving the body of the wall rough; but you must remember that if your architecture is to be good or elaborate, you must begin by working the face of the wall, so that the whole may be of one harmonious texture. The size of the stones and their jointing is equally to be thought of. As a rule, large stones are only to be used in large buildings, for the apparent scale of a wall depends much on the size of the stones that are used in it. The same is true if the available materials are brick or timber. With either of these the whole structure, every moulding and every detail of ornament, ought to be different from what they are in stone. Every material has its own capabilities, and the architect is bound to use each in its proper fashion. And here, on this point of making the best possible use of common materials, I may give you a quotation from Sir Henry Wotton, in the conclusion of which I think we may all very heartily agree:—

"It will, perchance, be said that this doctrine" [which he had been laying down] "touching the five orders were fitter for the quarries of Asia, which yielded 127 columns 60 ft. high to the Ephesian Temple, than for the Spirits of England, who must be contented with more ignoble materials. To this I answer that this need not discourage us. For I have often at Venice viewed with much pleasure an anti-porch after the Greek manner raised by Andrea Palladio upon eight columns, the Basis of Stone without pedestal, the Shafts of meer brick foot and half thick and consequently thirty-five foot high, than which mine eye hath never seen more stately of stone or marble."

He then describes how the bricks were made, and concludes,—"which short description I could not omit, that thereby it may appear how in truth we want rather art than stuff to satisfy our greatest fancies."

Finally, the architect must avail himself of the best as well as of the latest discoveries and inventions in construction. It cannot be right to build one day with arches everywhere throughout his work, and on the next to assume that no such convenient servant as the arch had ever been discovered. Nor is it reasonable to say, "I will use a round arch because I like it, but though I know that a pointed arch is more convenient, and, in some positions, far stronger, I dislike it so much that nothing shall persuade me ever to adopt it,"—a sentiment expressed with the honest frankness of his time by the old writer just quoted, in the following passage:—

"As for those arches which our artisans call of the third and fourth point, I say these, both for the natural imbecility of the sharp angle itself, and likewise for their very uncomeliness, ought to be exiled from judicious eyes, and left to their first inventors, the Goths or Lumbards, amongst other reliques of that barbarous age."

The Pompeian architect who carried the entablature above his columns on a concealed log of timber was trying to imitate the work of men who had been dealing with blocks of stone large enough to bridge the space from column to column, and there was laudable ingenuity in the Pompeian's device, who, having no stone to use, invented a substitute for it. But to us who know that such a substitute is not permanent in its nature, and that there is now a mode of carrying the wall above by arches over such spaces which may be absolutely permanent, there is no justification whatever for the imitation of the Pompeian mode of building.

In modern buildings the greater part of the construction is concealed, and there is a consequent temptation,—only too often acquiesced in,—to make it subservient entirely to supposed convenience. A common instance of this is the free use of iron as a concealed support in place of masonry. Our forefathers knew nothing of such aids to easy planning. When they made the plan of one floor they involved themselves in accepting the same plan for the floors above and below. Walls came above walls, and no little skill was required, therefore, so to plan the various floors as to make all the arrangements convenient, and yet subject to good and sound structural conditions. In our own time the temptation to carry walls on iron girders over voids is too often accepted as a matter of course; the ingenuity exercised in planning is diminished, and the structure is less permanent, for a flaw in the iron, its decay, or the accident of a fire, may involve the ruin of a whole building where, under the old conditions, the walls might have stood unharmed by such catastrophes. I do not, therefore, recognise such aids to construction as these as being real and genuine. They are rather temptations than anything else, and ought only to be adopted when it is clear that their use is not opposed to the principles already laid down. The architect who attempts by concealed construction to imitate a wholly different sort of work must inevitably fail, for sincerity is of the essence of good art, and the detection of insincerity is certain. Even untutored men will surely perceive that a deception has been practised, and will resent it. If you have such magnificent material that you can obtain it in masses of sufficient bulk, I can conceive no reason for objecting to the employment of trabeated systems of architecture. The vast bulk of the horizontal block or lintel is in itself impressive; and if it rests upon blocks of corresponding magnificence, in the shape of monolithic columns, there are few modes by which the imagination can be more surely excited. But the same sort of design executed with small stones, or with bricks covered with plaster, never impresses us in the same way, because the slightest attention discloses the fact that some unseen mode of holding the work together has been adopted, without which the whole must certainly at once collapse. The Mediæval architect was, like the Greek, a frank and sincere constructor. There was no disguise about his work. In his hands each stone may be said to have had its office and to have performed its duty. And there are few examples more illustrative of his feeling than those monuments and open porches which are so common a feature in Italian buildings. Here there are four arches carried on four single shafts,—a sort of construction which is really impossible. The architect frankly announces the fact that it is so by the exhibition of an iron tie across the base of the arch which ties the whole together, and makes the whole work, not only possible, but secure. The modern mode of doing the same thing would be to continue the columns up above the caps to support concealed girders. In this way the evidence of the tie is got rid of, and the eye is distracted by a feat of construction which, to those who are not in the secret, is wholly incomprehensible. In good work the external form is always a translation of the internal structure, a building, if it is perfect, being as complete an organism as the human frame.

So far, I think you will see that the principles which are necessary in all good architecture are almost beyond dispute. It may be said by some of you that they are mere truisms. Would that they were always so accepted and acted on! It is not too much to say that if they were absolutely accepted and always acted on little more would need to be taught. The man who never consented to break one of them would, depend upon it, have so much character as to make it certain that the ornaments of his construction, which convert building into architecture, would at least have that great force which comes from simplicity and fitness for their place and work. His ornament would be that of the construction, and would not be merely applied in front of it and without reference to it. His work would be so complete in itself and in its details that even as a ruin it would be beautiful. The ruins of the consummate works of the Greek architects are hardly less beautiful in their decay than they were in their perfection. Two thousand years of neglect have left the Temple of Neptune at Pæstum as grand and dignified, and well nigh as beautiful, as on the day of its completion, whilst the Gothic ruin is equally worth studying, and just as provocative of admiration as the Greek. Every part of its construction was useful as well as ornamental, and the destruction or decay of parts still leaves what remains instinct with power and beauty. How different may the case be! In a Roman building you may too often remove the whole *appliqué* face of the architecture, and the building will still stand, but in such a guise as to give you no sense of permanent beauty; whilst in a modern building it is sufficient to let it fall into decay to see how loathsome it has been from the first, for that "calm decay" which seems to give so many added charms to the Greek or Gothic fragment, discloses in it nothing whatever that

is good, or pleasant to the eye, or in any sense venerable.

We have next to consider how far, out of the vast array of facts which the student finds in the history of his art, some may be selected which involve the establishment of abstract truths. And to accomplish this we must examine the works of all times rather than of one period only, confident of this, that as all good developments in art have proceeded from the realisation of good principles dormant before, so the more these practices are traced home to the causes or theories out of which they rose, the more likely are we to perceive their true bearing.

The first essential of a building is, as we have seen, that it shall be well built. This is not architecture. Architecture is the art of giving "style" to building, and, after this, some or all of the other abstract qualities of Rhythm, Breadth, Scale, Light and Shade, Mystery, Repose. What, you may ask, is "Style"? I will answer you in the words of one of the most distinguished of my brethren (M. Viollet-le-Duc):—

"Style resides in distinction of form, and is one of the elements of beauty, though it does not itself constitute beauty. Our sense of style is instinctive. In the midst of an assembly you distinguish one man among all others. It is not beauty which attracts you in him, and yet, moved by a mysterious influence, your eyes follow him. If you have any power of observation, you find yourself arriving at some sort of explanation of the power he exercises. It is something in his frame, as well as in his contour, in his movements and the *rapport* which exists between them and his features and expressions. By degrees you have fixed ideas as to his habits, his tastes, his character. It is the first time you have ever seen him, and you know him not; but you build upon what you see a whole romance. It is only those who possess style who exercise this singular fascination. Mankind is so spoilt by false education, by infirmities moral and physical, that it is not common to find any who really have this quality. But look at animals, and you will find that they all possess it. There is never a false gesture, never a movement which does not follow on a want, a desire, or a fear. Animals are never affected, mannered, vulgar. Whether plain or handsome, they have style, because they have none but simple sentiments, and seek their ends by the simplest and most direct means. Man, and above all the most civilised man, being a very complicated animal, transformed by an education which teaches him to fight against his instincts, it is almost necessary for him to get out of himself, so to speak, in order to find 'style.'"

Style in architecture is the perfect harmony between the means and the end, which is found in all the ideas and desires of the highest type of man. Refinement of detail is indispensable; largeness and breadth are its natural forms of expression; but in certain places it may give greater grace to the most intricate and delicate work. It is this noble quality which is essential in good art, and it is as possible to have it in a building as in a man or a beast. The essential condition, you see, is that your style should be a true and sensible expression of simple and abstract principles or requirements. It has nothing whatever to do with styles of architecture, as we call them, for it is possible that every one of these in succession may afford examples of incontestable style. This, at least, is clear, I suppose, to all of you,—that a vast chasm exists between architectural designs; that some are vulgar, affected, mannered; whilst others are natural, simple, and dignified; and that whilst the only admiration ever extorted for the former is that ignorant love of a new thing which is so evanescent and so little to be respected, the admiration of the latter increases as they grow older, and year by year becomes more certain and universal. The popular voice, which finds something worth loving after an age has passed since the construction of a building, is as unerring in the correctness of its judgment as the supposed approval of a new work is fallible and to be mistrusted.

The next quality at which we must aim is, like the former, one which is common to our own and other arts. The poet cannot afford to neglect style in his work any more than he can venture to trifle with its rhythm, and a perfect building has its rhythm as well as its style. It is a quality very difficult to describe in words, but in architecture it is an art depending on numbers and proportions. Some expression caught up, repeated, balanced, emphasised in succeeding passages, at intervals which are either regular or regulated, constitutes usually the rhythmical beauty of a work of architecture. No doubt it is sometimes secured by direct application of geometrical figures, at others by that instinct for the beautiful which makes a trained eye go so near to the figures or proportions which might be drawn by rule, but to which the charm is added of something which is fresh, human, and suggestive in its very departure from exactness. Take the simplest case conceivable, that of a Greek portico. Arrange the columns with perfect regularity and without any thought, and there is no rhythm; but arrange them so that a dominant point in the base shall be placed in a certain relation to another, as, *e.g.*, the centre in one of the columns or capitals, or in the pediment, and that the line which connects these two points be one which, if repeated again, connects other marked features, and you at once have a simple and admirable sort of rhythm. Or, take another case, to prove the point by a negative. Design a tower, 300 ft. in height, and divide it into twelve equal stages, and you will have an erection which will have no more rhythm than the empty sheet has before the poet has covered it with his rhythmical lines. Yet such a tower may possess all the qualities which I have up to this point included in the conditions precedent of a good piece of architecture. It may be solid, simple, suitable for its purpose, and may even have a certain style, but not having rhythm, it is not architecture at all in any good sense. If we wish to see how the opposite effect may be produced, let us see how Giotto planned the proportions of his tower or campanile at Florence. My drawing shows you this design in elevation. You will perceive that it is divided into seven principal stages in height. Of these the six lower are grouped in pairs, and so arranged by lines of dark marble and stringcourses as to increase in height as they leave the ground. In the two lower stages, the panels, being very near the eye, are of the same height. In the next coupled stages the upper windows are one-seventh larger than those below them; the fifth and sixth stages are nearly equal, but the upper one has panels marked with an outline of serpentine one-tenth longer than those below. Finally, the single story of the upper stage is equal to two of those below, and crowns with rare grace this succession of coupled stages which have gradually led up to it. The diameter of the tower is the dimension which appears to regulate the whole scheme, being one-sixth of the whole height. The gables over the windows are of the angle whose base is as 3 to a perpendicular of 4 and hypothenuse of 5,—according to the ancients the perfect triangle, the square of the hypothenuse being equal to the united squares of the two sides. But the square or circle seems to have been the figure mainly used by Giotto in arranging the lines of his work. In Giotto's tower I have given you an example which shows, I think, how conscious one of the greatest artist was of the use of some definite system of proportion. It is not possible to give you an incidental treatise on so large a subject, in the midst of a lecture which has to embrace so much in so short a time. But in a few words I may direct your attention to it, with a view to inducing you to follow the subject up for yourselves as you have the opportunity. I will take one only out of many figures which has been made much of in old times, and this is the equilateral triangle. There can, I think, be but little doubt that the proportions of the Pyramids were decided by it. Take four equilateral triangles and incline them to each other to a common centre, and you have, as nearly as may be, the outline of the finest among them. The equilateral triangle has always been one of the most favourite forms, but especially was it so in the Middle Ages. Westminster Abbey and Stone Church are both designed with its aid, and M. Viollet-le-Duc has given several French examples,—Notre Dame, Chalons, if I remember rightly, among others. Old writers frequently enlarge on the virtues of this and other such figures to the architect, and though in the use of many of them there seems to be something rather empirical, it is not possible to doubt that they have influenced architects in almost all ages.

It is obvious that in all systems of proportion, the parts or divisions of a building which are treated in relation to each other must be either really connected with each other, or so visible together at one time as to be naturally looked at as united members. There need, therefore, be no connexion between the lines which settle the proportions of the interior and exterior of a building. What is intelligible is that there should be a distinct relation or system of proportion between features which the eye is certain to compare together,—as, *e.g.*, the height of a column to that of its entablature, the dimensions of a metope to those of a triglyph, and the proportions of both to the diameter of the column and the width of the intercolumniation. Another mode of deciding the proportions has been ingeniously formulated by Mr. Watkiss Lloyd in his calculations as to the system of proportion adopted in the Parthenon. It is impossible to deny that his discovery appears to be a real, and, if so, an important one, though the system adopted seems on the face of it to be wholly arbitrary. He shows that the proportions are all derived from a system of figures standing in the ratio of 1 to 6, that is, separated by the number five,—as, for instance, 1-6, 2-7, 3-8, 4-9, 5-10, and so on. Thus the breadth of the top step is to its length as 4 to 9. The height and width of the front as 9 to 14, and the height of the front to the length of the building as 2 to 7, and so on. What is not clear is whether such a system was peculiar to this one building; and even then I fail to see why it should produce a good result. Vitruvius, speaking of rules for proportion, says that,—

"The ancients have directed these to be observed in all works, but more particularly should they be attended to in the temples of the gods, in which the faults as well as the beauties remain to the end of time."

And for the last two centuries or more men have been endeavouring to discover what these rules are. They have succeeded in ascertaining many facts of the highest interest. And there is evidence that in Mediæval times similar rules were observed to those which Vitruvius laid down. To mention one only. In 1521 Cesare Cesariano published a book on the subject. Cesariano, in his Commentary, gives a plan, section, and elevation of Milan Cathedral, which, after Vitruvius, he calls the "Ichnography," "Orthography," and "Scenography." *A Trigono as Pariquadrato perstructa Germanico more.*" And "*Secundum Germanicam Symetriam.*"

Professor Cockerell took much pains, many years ago, to show that William of Wykeham planned the chapels of his colleges at Winchester and Oxford by the aid of geometrical figures, and there is, no doubt, something fascinating in the suggestion of any scheme which shall involve as a certainty a well-proportioned work. Whether laws can be laid down which can be generally applied is open to grave doubt; but Cockerell's words are, in any case, true, and worth quoting:—

"The perception of proportion, the fundamental element of the beautiful in architecture, seems to be the last acquirement of the student instead of the first. We begin by admiring ornaments, details, and forms; but it is at a more advanced stage only that we make all these subordinate to that sense of rhythmical proportion and that harmony of quantities which affect the mind like a mathematical truth, and, like a concord of musical sounds on the ear, is perceived and confessed by the eye as obvious and unalterable."

The only fear in such investigations as these is that any of you should be led to suppose that any system can stand in place of the genius of an artist. The utmost that you will arrive at by such a process is the avoidance of errors of general proportion, it being very manifest that this is possible.

But it would be a calamity if you were led to suppose for an instant that the use of a mathematical formula could or ought ever to be substituted for the cultivation of the eye, that is, of the natural sense of good proportion or rhythm in architecture. It is by the careful observation of cultivated eyes that some of the most delicate, and at the same time most important, rules have been arrived at for our guidance. A few of these may shortly be referred to here. There is, first, the entasis of the Greek column. The column, first of all, was made to taper, so as to give it the greatest possible appearance of stability, and then it was perceived that there was some appearance of the outer lines being very slightly concave. This is an effect which you will find constantly in absolutely straight lines. A ceiling, the side of a spire, a long line of steps, will all of them, if absolutely straight, appear to be concave. The Greek artist remedied this by the most delicate increase of dimensions, giving his column an almost imperceptibly convex outline,—no more than was enough to correct the ocular deception which the straight line produces. In old examples this entasis appears sometimes to be exaggerated, owing to the decay of the stone or marble at the junction of the column with the capital. And it is important to notice, also, that the entasis was not given where good reason existed for omitting it. Thus, in the two ranges of columns forming the *cella*, the columns of the upper range are continuations of those below them, with an entablature inserted between them. In this case, if the upper and lower columns had had any entasis, there would have been a disagreeable conflict of curves, and so these columns are all formed with straight outlines. Another practice was to make the columns slope slightly inwards, so as to give

a greater appearance of strength; another, the placing of the outside columns nearer to each other than the rest; another the giving a slight curve to the architrave, for the same reason as the entasis was given to the column; and another the making the whole tread of the long line of steps on which the temples were placed slightly higher in the centre than at the ends. In Gothic architecture you will find the same delicate modifications to meet various optical effects. Spires undoubtedly sometimes had an entasis. It was usually so delicate as not to offend; and, indeed, it may almost be said that directly the entasis is obvious it is offensive. The spire-lights and pinnacles of spires were also so contrived as to produce the same effect. Then columns were often banded, not in the centre, but slightly above the centre. The reason is that if you band a column in the exact centre the upper half of the column is certain to look longer than the lower half. Then, just as the Greek column was inclined, so are the walls of many steeples. Good examples of this are seen in some of the best of the beautiful group of Normandy steeples which make the neighbourhood of Caen such delightful ground to an architect. Another delicate adjustment is constantly adopted in old traceries, but seldom, I fear, noticed. This is the change in the dimensions of mouldings where the tracery becomes intricate, and where the moulding proper for the large lower lights of a window would, if carried throughout in a mechanical way, entirely block all the smaller lights and spandrels of the tracery and cusps. Another is the stilting of arches slightly, in order to make the curved line sit with sufficient quietness and dignity on the cap; another the modification of the curved lines of cusps to give the same effect. These, indeed, were often drawn by hand; no other way allows of their curves showing such delicate growth. At Lincoln, the cusped arcades are all so drawn. In the Italian arched canopies to porches and monuments, where the arches are so constructed as not to be able to stand without iron ties at the base, the arch was weighted on the under-side with a somewhat heavy trefoil, the effect of which was to give an appearance of stability. These illustrations will be sufficient to show you how universal has been the desire of architects in all ages to adopt the most subtle variations for the sake of securing the best possible effect in their work, and how important it is, therefore, to remember that the training of the eye is far more necessary to the architect than the closest adherence to the precepts of Vitruvius, and those who have followed in his steps, interesting and valuable though these precepts may often be, and full of suggestions well worth following out.

The other elements that I have named are what we look for in the best work, but they are not so indispensable as those already mentioned, and for this reason: they are elements which may be aimed at, more or less, according to the choice of the architect. He may aim, if he chooses, at breadth of effect; and he will always do well to do so. But he may equally aim at a picturesqueness which sacrifices breadth, and which, if it arises naturally out of the conditions of the case, is by no means to be despised. In all cases, also, the treatment of the design with the object of impressing the eye with a real idea of its scale is important. It hardly admits of discussion whether or no the artist is skilful who makes the scale of his building look smaller than it really is, for it requires much skill so to dispose and proportion the various members as to make each appear to be of the right size for its place, and yet to add to, rather than diminish, the apparent size of the whole. But I think all these points will be more easily dealt with if we go on now to consider, as far as time will admit, the evidences we have in ancient buildings of the close attention which was paid by their designers to subtle principles which it is necessary to master if we are to produce work at all comparable to theirs.

In one point all ancient work agrees. This is, that all parts of a building must be equally well designed. No good work is ever done which is done solely for show. If you really love your work you will make it good all round,—as simple as you like: for it would be absurd to make work which can hardly be seen as elaborate as that which is meant for the delight of the eye of every passer-by,—but still good in its proportions, and in its detail wherever any is introduced. To how many buildings of the first half of this century would it be possible to go with this impression of an architectural *sine qud non?* The truth is that only too often men seem to have thought that one elevation of a building would be all that would ever be seen. They have satisfied themselves with handsome geometrical elevations of the principal front, and have assumed that every one would be polite enough not to look at the work in perspective. So you see grand cornices in front, none at all at the ends, stone on one side, compo on the other, and other similar mistakes. For the same reason, no discovery that old architects often indulged in sham fronts to their buildings justifies their erection now. From some point of view, the deception is quite sure to be detected, and when found out produces the worst possible effect. Moreover, it is hardly possible to design a sham front which does not at once condemn itself, because it almost always happens that the features, which are used merely because they are pretty, having no corresponding structure behind them, have no structural effect, and thus prove themselves to be unnecessary impostors.

A sham feature is often introduced for the sake of symmetry, and it is worth while to consider how far the symmetry which depends on uniformity is a necessary feature. The uniformity which arises from an absolutely similar requirement throughout a building is natural and defensible. Examples of it may be seen in the repetition of the columns round a Greek temple; in the uniform design of the outside wall of a Roman amphitheatre, where each bay, having similar requirements, is almost identical with the rest; and in the bays of a Gothic cathedral nave, all of which are almost of necessity alike, because each follows exactly from the same construction. Nevertheless, uniformity may easily ruin the effect of a work in which, in the right place, the principle has been admitted to the full. Imagine, for an instant, such a work as Notre Dame, Paris, altered for uniformity's sake by the erection of a choir exactly like the nave, with two eastern steeples corresponding with the grand examples at the other end, and you will see at once how entirely ruinous this sort of symmetry may be.

Repetition of similar features where the requirements are the same seems to me to be the true sort of symmetry to aim at. In this way you gain the required effect without sacrificing convenience or truth. Then, if the site is not symmetrical, or if the building is the result of a series of erections at different periods by way of additions to something older, it is far better to give up the idea altogether, and to let the building tell its story. This is the way in which the Greeks acted on the Acropolis at Athens. Nothing can be more deliberately unsymmetrical than the planning of the matchless buildings on this sacred spot. The temple called the Erechtheum is an example of the most singular interest in this way. The Greek artist not only disdained the attempt to make all the buildings agree with each other, but may rather be said to have been bent on making them all as different as possible. He then placed them at all sorts of angles with each other, knowing that the picturesque effect of which he was so fond would thus be secured, so that, in truth, the whole group may rather be said to be too deliberately picturesque if it has a fault at all. The houses, temples, forum, and other buildings at Pompeii are examples of precisely the same feeling. They all bear distinctly the marks of their history. Each house had its own character, and its own arrangements. There was no pretence anywhere to accommodate the architecture of a whole street to what might be deemed to be the average wants of the inhabitants. And in the street which above all others has architectural character,—that of the tombs,—you walk now, as men did from the first, between a succession of more or less stately monuments and monumental chapels, none of which have been made with any reference to the effect of their neighbours, but solely with reference to the wishes, the pride, or the wealth of the men who put them up. In the same way the forum is regular, but the temples which surround it are quite irregularly arranged, and upon altogether different designs; and the laying out of the streets, not being regular or rectangular, just the same irregularities occur that we find as a result of natural growth in our own old towns. In Mediæval times precisely the same view was taken as by the Greeks. Historical truth and life-like character in the design were preferred to uniformity as an almost invariable rule. And in all good work you will find, even where there is apparent symmetry, that considerable differences exist. At Notre Dame, Paris, the two western steeples are essentially symmetrical, and were probably erected at the same time; but there are important differences of detail in them, which give a charm and life to the work which it would not have had if each had been a mere repetition of the other. And in earlier times, in the façades of St. Mark's, at Venice, and of the Cathedral at Pisa, you will find that the apparently corresponding dimensions of doorways and arches do not really tally at all, and have evidently been deliberately varied, in order that the eye might be unconsciously saved from the weariness produced by too great uniformity.

The Mediæval architects have left some most remarkable examples of the extremely small effect that the desire for uniformity had upon them. Of this there is, perhaps, no more convincing example than the façade of Chartres Cathedral. This had a west front, flanked by two steeples, one of which only was completed by the end of the twelfth century with a spire, which, for beauty of design, is not far behind the very best of its period. It was no sooner built than the whole church, save the west front, was rebuilt after a fire, and on a grander scale, so that the new nave roof, reaching to the base of the spire, very much spoilt its effect. Then, in the fifteenth century, one of the greatest men of his time, Jean Texier, was employed to build on the ancient north-west tower a second spire to complete the front. What course do you suppose he adopted? The nineteenth-century answer is, of course, in favour of a steeple exactly like the first, so that though both would then be too low for the roof, there might nevertheless be that uniformity which is now usually supposed to be the right thing to strive for. Texier did nothing of the sort. He boldly declined to look at the early spire, and simply set himself to work to build the loveliest spire he could design. And his work is a success from every point of view. It is exquisite in itself, properly proportioned for the height of the church, and though so unlike it, groups well with the other spire, and the result is that we have the pleasure of seeing two *chefs d'œuvre* where otherwise we should have had only one design to admire.

Some of you may perhaps ask whether, after you have done your best to attend to all the principles which I have been insisting on, your work could be worthy of being called really one of architecture, in the absence of all sculpture and painting. Some writers,—and they are men of the greatest authority,—deny by implication that they can be. But though in my last lecture I told you how strongly I desire to see the three arts employed together, I am not disposed to allow this, and I shall insist upon it now, because I think that for young men the habit of designing without the aid of figure sculpture is very important. A drawing of a poor design may sometimes be made to pass muster by a daintily-drawn representation of sculpture, but this is not what is first wanted. At the same time, though it is necessary to be able to dispense with the aid of the sister arts, it is equally necessary that you should know how to avail yourselves of their assistance. The best work is that, as I have before told you, in which all the arts are combined. And no form of architecture can be pronounced to be contemptible in which these accessory arts have been highly developed. The grandest architecture can, however, exist without such aid. It is not absolutely necessary; and if circumstances compel the architect to dispense with it, he is in no degree whatever relieved from the necessity of doing the very best work. Certainly we have only to think of some of the buildings which are amongst the noblest works remaining to perceive that they never depended entirely upon sculpture for their effect. Little, if any, is left on the remains of Greek art. The sculpture is now in museums, and the architecture, unadorned by it, often still remains. No one can say that the buildings have obviously suffered by its removal, for in some it can hardly be said whether there ever was any sculpture or not; and yet in such cases, of which the Temple at Bassæ and the Temple of Neptune at Pæstum are typical examples, it is impossible not to feel impressed in the highest degree by the art exhibited. The same feeling is excited by the monasteries built by the Cistercian order. They were built under a rule which prohibited all use of sculptures or paintings; and yet, I suppose by common consent, they are among the most precious relics of old times that remain in the world, and their most enduring charm is the delicate grace of all their architectural lines

and details. Even in the case of a building such as Chartres Cathedral, in which sculpture and painting play a most important part, it is not in their presence or in thinking of them that the imagination is most impressed. It is probably on the exterior, in some general view of the building, that this happens. And in the interior it is when, looking down the mighty nave, we see the great columns, the vast clear-story, and the vaulted roof high above, that we feel the impressiveness of the building, and the power of the man who built it. An impression created in this way is, indeed, one of the advantages which our art possesses. She can satisfy the critical eye with beauty of detail, skill in construction, and harmony of proportions, but at the same time she appeals to a much wider world than that of connoisseurs by her ability to stir the imagination and touch the feelings of the humblest. The means by which this is accomplished are the management of masses, of light and shade, and the intricacy or mystery of the composition. Each of these may be done in a variety of ways, and the same treatment is not available in all countries alike. In Italy and Greece, for instance, under the influence of a brilliant climate, the wall is to the architect like a canvas to the painter, on which every line may be made to tell with precision, and where even the slightest line has its proper force. In the North it is almost necessary to break this wall in order to produce the shadows. For the same reason the more you can deal with deeply-cut mouldings the more certain you are in this climate of your effect. The primary use of them is to give the architect the power of manipulating and managing the lines of light and shade. A moulding well designed produces the required effect even when there is no sun to light it up, and it is not a little curious that England, having less sunshine probably than any other part of Europe, is the country in which the moulding of architectural features has been carried to the greatest perfection. But one of the results of having to depend on lines for effect is that with us the line is everything, whereas in Italy the wall is all in all. In the best Greek art the line and the wall surface were equally cared for. The Greek delighted above all things in making his work as distinct and clear as possible. The delicate lines of his fluted columns, the ornamented mouldings, and the clear bold relief of the statuary all show this. But the Egyptian, and, after him, the Italian in the Middle Ages, were happiest when the sun could play on the long unbroken front of a building as it does on the upper stage of the Ducal Palace at Venice, or on the vast and almost unbroken walls of the greater palaces and town-halls in Siena, Verona, Pisa, Florence, or Perugia.

The mystery which is so dear to the Northern mind has comparatively little power in the South. But it is a power which the English architect must know how to use. Nowhere is one more visibly impressed by this than in some of our own cathedrals, where the vast length, aided by intricacy of line, variety of detail, and skilful manipulation of light and shade, produce often most exquisite effects. A building in which the light is all equal is that in which the architectural effect is the smallest. That in which the variety of light and shade is greatest, though divided in broad and well-accentuated groups, is that in which it is best, even if its detail is not always perfect. Closely allied to the light and shade is the composition of the outline. As long as this follows a convenience or a necessity in the plan, it is more than merely justifiable; but the determination to obtain an irregular and picturesque outline at all cost is not to be commended. All good buildings teach us the importance of dominating horizontal lines. Without them there is no repose. Contrast the effect of the steep roof of a Gothic cathedral with that of a building where pinnacles rise up against the sky, and you will see how superior the former is. Westminster Abbey and Henry VII.'s Chapel are good illustrations of this. In one the vertical lines are strong as they can be; but they are controlled by the quiet horizontal line of the roof, which in the other is not allowed to produce any effect upon the design.

I have now, I think, touched on most of the principles, strictly so called, by which the good architect is bound. You see that they are many in number, but that they all resolve themselves into an observation and obedience to certain and very few first principles. The best Greek architects and sculptors were the best by universal consent that the world has ever seen, and with a few words upon their work I may well conclude this lecture. Observe, then, that their one object was to secure the utmost refinement, satisfying, at the same time, all the requirements of the best construction. They had the blessing of a sunshine which gave effect to the most delicate lines, and which allowed of their buildings being decorated with a brilliancy of colour almost past belief. Nothing so well proves their extraordinary delicacy of observation as their matchless sculpture of the nude. This was the effect of study of life in active motion by the eye, rather than of merely anatomical knowledge. And all the details of Greek art seem to prove that they result from an extraordinarily patient and delicate observation of the influence and effect of light as well as of the true necessities of construction. If the same men had had to build in Northern Europe, of course they would have modified their style in endless respects to suit so different a climate. But wherever they built, it would have been as worthy of admiration as in Greece, because their work would still have been done with all their heart and all their power; and because they realised (as all of us must, if we are to be good architects) by their actions, if not consciously, that all noble ornament and all good work are an expression of man's delight in God's work, and that without the refinement which we see everywhere in nature, no work of our hands is worthy to be called a work of art.

THE PARTHENON: ITS ARCHITECTURE AND HISTORY.

THE CHRYSELEPHANTINE STATUE OF ATHENE.

PROFESSOR C. T. NEWTON'S third lecture* of his course on Greek art in the age of Pericles, delivered on the 4th inst. at University College, dealt with the Parthenon, its architecture and history; the sculptured compositions in the two pediments; and the chryselephantine statue of Athene. Referring to a plan of the Parthenon, enlarged from that given in Mr. Penrose's book, the lecturer pointed out that the naos or cella was divided into two unequally-sized chambers. The smaller one was called the opisthodomos, or back-chamber, and was the treasury of the temple. In the larger chamber stood the magnificent chryselephantine statue by Phidias of the goddess to whom the temple was dedicated, —Athene Parthenos, or Athene the Virgin. The name "Parthenon" was at first confined to that part of the temple in which the statue of the goddess was placed, the temple itself being at first called the Hecatompodos, but in course of time the name of the chamber of the goddess came to be applied to the building as a whole. Externally the temple had exceedingly rich sculptural decorations. Running all round the walls of the *sekos* or *cella* was a frieze, the greater part of which was now to be seen in the Elgin Room of the British Museum. Then in the pediments there were exceedingly rich compositions (the subject of the eastern pediment being, according to Pausanias, the birth of Athene, and that of the western pediment the contest between Athene and Poseidon for the soil of Attica), and below the pediments, but above the architraves, were spaces between the triglyphs, called metopes, filled with sculptured compositions of the highest excellence, though necessarily on a smaller scale. Of all this wealth of sculpture, Professor Newton said he should confine his attention in the present lecture to the chryselephantine statue and the pedimental compositions, reserving for his next lecture the frieze and the metopes. But, before describing the chryselephantine statue, he would say a few words as to the history of the Parthenon. It was finished just before the outbreak of the Peloponnesian war, B.C. 438, and it remained in almost all its splendour, very little injured, until the time of Plutarch, who, writing in the second century, described it, among other temples, as possessing all the freshness of youth. Its history could be clearly traced down to the time of the fall of Paganism, when the chryselephantine statue disappeared from view. The Parthenon, on the establishment of Christianity, was converted into a church, and it remained a church all through the Middle Ages, passing from the Byzantine Greeks to the Latins under the Dukes of Athens, then to the Venetians, from whom it was taken in the fifteenth century by the Turks. It was reconquered by Morosini for the Venetians at the end of the seventeenth century, passing back to the Turks again at the beginning of the eighteenth century, and being finally restored to the Greeks on the establishment of the Greek kingdom fifty years ago. What was originally the principal entrance of the Parthenon, at the eastern end, became in the church the most sacred portion, the entrance being made at the western end. Under Turkish rule the temple was used as a mosque. As to the chryselephantine statue, there was great difference of opinion as to the exact position on which it stood. It was known beyond doubt that it stood in the larger chamber of the temple, and an oblong space on the floor of the chamber, some little distance eastward of the wall of the opisthodomos, and paved with a commoner marble than that used for the remainder of the floor, was supposed by some to indicate the site of the statue. Recent German investigators had asserted that the statue stood close up against the wall of the opisthodomos, and they professed to see traces of a recess in the wall. Professor Michaelis, in his excellent book on the Parthenon, had adopted the same view, and further expressed the opinion that the differently paved oblong space referred to was occupied by a large table on which to place the garlands and crowns given to the victors in the Pan-Athenaic festivals. Mr. Fergusson, on the contrary, was of opinion that no case had been made out for that view, and that the statue stood well out free from the wall on the space indicated by the inferior pavement. Formerly, it was supposed that the roof of the temple was open, and that it was what is known as hypæthral, there being a square opening in the interior corresponding to what in a Roman or Pompeiian house would be the impluvium. That there were hypæthral temples was known to be the fact, but in Mr. Fergusson's opinion the Parthenon was roofed all over, that portion over and in the immediate neighbourhood of the statue being lighted by a sort of clearstory, so that the great chryselephantine statue might be well seen all round. The ancients had left on record some very remarkable statements about the statue, which was the work of Phidias. It was stated to be 32 ft. high without the base, which latter was also of a good height. The statue, as its name imported, was of gold and ivory, the flesh being represented by the ivory, and the garments by the gold. The amount of gold used on the statue was, according to good authorities, 40 or 44 talents, or 135,000*l.* or 148,500*l.* English money. With regard to the question whether there were any known representations of the statue extant in art, the lecturer said there were no doubt many imperfect representations, made from recollection, probably, on coins and gems, and in the shape of more or less rude copies made to recall in some degree to distant worshippers of the goddess some idea of the statue, as an aid to devotion, just as the crucifix was used by Roman Catholics. Professor Michaelis, in the last plate of his work, had brought together views of all known attempts at representation of the statue. Many restorations of it had been made, the most noteworthy being that by Quatremère de Quincy, the French archæologist, published fifty years ago. This restoration was now, however, shown to be inaccurate in many important respects, and its inaccuracy was established more conclusively than hitherto possible by comparing it with the statuette of Athene lately discovered at Athens. It was, of course, very difficult, by the aid of the scraps and shreds of evidence which were available, to realise what the statue was like. It served, no doubt, a double purpose. Firstly, it was, like the Zeus of Olympia by the same sculptor, intended to enhance and develop the religious feeling of the Greeks in the highest form. What Cicero and others had said of the Zeus of Olympia would doubtless be true of the statue in the Parthenon, viz., that "it added something to the received idea of religion." In the archaic period the people's conception of a god might have been very much higher than was bodied forth in the rude statues of the time, some of wood and some of bronze. The period of Phidias marked the turning-point in the history of Greek sculpture, when the imagination of the artist, as embodied in his statues of deities, surpassed the imagination of the worshipper, and, indeed, surpassed nature itself, for the types conceived by Phidias were ideal types. The reason why gold to so great an extent was used in the statue was given by Thucydides, who recorded that Pericles, before the Peloponnesian war, after telling the

* For reports of first and second lectures, see *Builder*, pp. 65, 152, *ante*.

people that there was so much gold coin and bullion on the Acropolis, ordered the statue to be made, the gold used for it being regarded as a kind of investment, capable of being converted to useful purposes in time of war or other necessity, and of being replaced in times of prosperity and peace. It formed, in short, a sort of metallic reserve. The money thus invested gave no return other than that of ministering to the honour of the goddess and the pleasure of the people, but such a return was deemed to be all-sufficient. Professor Newton described the nature of the treasure in gold coin and vessels stored up principally in the opisthodomos, but also in the chamber of the goddess, and observed that the temple was in reality a bank, the people banking, so to speak, with the goddess. The treasure was perfectly secure, because it was universally regarded as an act of inexpiable sacrilege to rob a temple. In conclusion, the lecturer discussed the frieze and the remains of the pedimental sculptures now to be seen in the British Museum, and exhibited drawings of the latter as they existed before the damage they sustained in the wars between the Turks and Venetians.

In his fourth lecture, delivered on Friday, the 18th inst., Professor Newton, instead of taking for his subject the frieze of the Parthenon and the metopes, reserved the frieze for the next lecture,* in consequence of having received photographs of the statuette of Athene recently found at Athens. From these photographs a drawing to the full size of the statuette had been made under the lecturer's directions, and was exhibited in illustration of his remarks. He dwelt at some length on this statuette as throwing light on the chryselephantine statue of Athene in the Parthenon, of which it was a rough copy, made, no doubt, for votive purposes. The figure of the goddess in this statuette had a helmet with three very high crests, with a sphinx in the centre and a griffin on each side. Over the breast is the ægis covered with snakes, in the centre of which is the Gorgon's head. Below that is seen a richly-flowing garment reaching to the feet, which might be taken to be one kind of tunic or *chiton*, worn over another garment underneath, or what appeared to be two garments might be only one great vestment folded in such a manner as to present the appearance of a tunic worn over another garment. Nothing was more difficult than really to find out how the garments of the Greeks were made and worn, and the lecturer did not think we should ever know until the ladies took up the subject and gave us *tableaux vivants* by wearing the Greek drapery upon their own persons. Something on the subject was to be learned from Mr. Tennyson's tragedy "The Cup," now being enacted at the Lyceum Theatre. But whether the goddess as shown in the statuette is draped in one or two garments, the arms are left bare. The left hand of the statuette rests on the shield, the right hand supporting a Victory, whose head, unfortunately, had not been discovered. The statuette was undoubtedly in all essential points a reduced copy, though a dull, cold, lifeless, Roman copy, of the famous chryselephantine statue of the Parthenon. That the statuette was meant to be a representation of that famous work of Phidias there was evidence in the writings of Pausanias, who mentioned that the left hand of the chryselephantine statue held a spear, *i.e.*, in the same hand that supported the shield. The probability was that the goddess was represented as holding the spear between the thumb and forefinger of the left hand, while the remaining three fingers of the hand grasped the top edge of the shield, the lower edge resting on the ground. Pliny told us that the statue was 26 cubits high, and that on the outside of the shield was depicted, in relief, the battle of the Greeks and Amazons, and on the inside the battle of the gods and giants. The same writer told us that upon the base of the statue was a sculptured representation of the birth of Pandora. Plato says that the hands and face of the statue of the goddess were of ivory, and that the pupils of the eyes were of stone,—he did not say what stone, but doubtless of some precious stone, representing the blue eyes of the goddess. Then there was a very curious notice of the statue in Aristotle, who (and later writers following him) tells us that in the representation on the shield of the battle of the Greeks and Amazons, Phidias introduced his own portrait in the form of an old bald-headed man lifting up a stone with his hands. But, as the Athenians were exceedingly jealous of portraits being introduced into the temple of the goddess, Aristotle told us that Phidias so arranged his head that if it were taken out of the shield the whole work (it was not quite clear whether merely the shield or the statue as a whole was meant) would fall to pieces. It would thus appear that the shield, if not the statue in its entirety, was a piece of mechanism so contrived as to be keyed or wedged up by the representation of the head of Phidias. The statue was, it should be remembered, a mere built-up framework, on which the gold and ivory were laid. In turning to the question of what existing monuments or remains there were which were confirmatory of the statements of ancient writers as to the statue, Professor Newton again referred to the representations of the goddess on coins, gems, &c., figured in Michaelis's book. It was noteworthy, however, that in the statuette recently found at Athens, a column,—architecturally of a very debased type,—was introduced as a support to the right arm of the goddess,—*i.e.*, the arm which held up the Victory. Now, there was no evidence of this given by ancient writers, and although in one or two ancient reliefs representing the statue a column was introduced to support the arm, there was, the lecturer thought, no valid ground for assuming that the original chryselephantine statue had such a column to support the arm, and therefore he had arrived at the conclusion that the column was introduced with the simple view of strengthening the arm of the statuette, which was in marble, and likely to be broken off without some such support, and which was doubtless only intended to recall to the worshippers of the goddess the main features of her famous chryselephantine statue. How the arm of the original statue was made, unaided by a column or some such support, to sustain the weight,—which was no doubt considerable,—of the statue of Victory which she held in her hand, he was unable to say. The weight of the statue must have been considerable, and from the way in which the arm was held out, the leverage exerted must have been very considerable. Probably a bar of copper extended throughout the whole length of the arm of the statue. At any rate, the statue of the Victory was so securely held that its security became proverbial, and it was commonly said that "The Victory stands upon the hand of Athene for all time." Having compared the statuette just found at Athens with Quatremère de Quincy's restoration of the statue, the lecturer noted as a curious circumstance that Flaxman, whose drawings and sculpture were the just pride of University College, in one of the plates of his "Lectures on Sculpture," gives a restoration, made by him from his own intuitive Greek instinct, in which the spear and shield were shown sustained by the left hand in almost identically the same manner as previously mentioned. In conclusion, the lecturer dealt with the metopes, of which the Elgin Room of the British Museum contains sixteen. In the course of these lectures, Professor Newton several times referred his audience who desired more detailed information to the "Guide to the Elgin Room," written by him, and published last summer.

* Professor Newton announced that this deviation from the programme would involve the necessity of his giving an extra lecture. The fifth (and what was to have been the concluding) lecture of the course will be delivered on the 4th proximo, when the frieze will be described and commented upon. The extra or sixth (and final) lecture of the present term,—which will be free to the public,—will be delivered March 11, at 4 p.m., and will be devoted to the sculptures of the Temple of Zeus at Olympia.

City Property.—At the Auction Mart, Mr. Alderman Ellis (of the firm of Farebrother, Ellis, Clark, & Co) offered for sale No. 3, Threadneedle-street, which is situated opposite the Hercules-passage entrance to the Stock Exchange, and faces the junction of Old Broad-street and Threadneedle-street. The premises are held under a lease from St. Thomas's Hospital for a term of eighty years from 1853, at a ground-rent of 268*l.* per annum, and were offered with possession. The alderman, in introducing the property, said the rental value of the premises he considered quite 1,800*l.* a year, which, at only sixteen years' purchase, after deducting the ground-rent, gave 24,000*l.* On the present occasion he ought to be able to obtain for it at the very least 20,000*l.* 10,000*l.* was first bid, and ultimately 17,500*l.* was reached, at which price the property was sold.

THE GREAT DISCOVERIES AT OLYMPIA.

Respecting the final series of excavations carried on at the expense of the German Emperor in Olympia, Dr. Dörpfeld, one of the staff engaged on the work, publishes an interesting account in the official *Gazette* of the German Empire. After being suspended for four months during the hottest months of 1880, the operations were resumed for the last time on the 21st of October; they are to be brought to a definitive conclusion at the beginning of March. The number of labourers employed is far less than hitherto. The work to be done included, beyond the cleansing of a number of objects already found, only the search for certain yet undiscovered topographical points indispensable to complete the general picture of Olympia. Results of very considerable value have been attained in this final series of excavations. Almost all the remains of buildings previously unearthed, including the Temple of Zeus, the Heraion, the Thesauri, the Leonidaion, and Gymnasion, have received important additions, while some works have been found which had hitherto escaped discovery. Among the most important results is the extraordinarily complete reconstruction of the interior of the Zeus Temple, which was facilitated principally by the discovery and restoration of the basis of Phidias's chryselephantine statue of Zeus, one of the most celebrated monuments of antiquity. In this work the excavating party were assisted partly by the traces still found in the *cella*, and partly by the description given by Pausanias. The excavators are rewarded with the knowledge that they have thus succeeded in restoring the interior of a Greek temple far more completely than had hitherto been possible. Even the position and construction of the *hypæthron* were very fairly made out.

The basis of the Zeus Colossus, which was of black limestone, about 6½ mètres wide and 9½ mètres deep, occupied the western portion of the *cella*, but stood so far from the wall of the *opisthodomus* that there was a passage behind of the breadth of the side aisles. Immediately in front of the monument, and exactly in the middle of the temple, was a floor of black limestone, about 6½ mètres broad, and surrounded by white marble. This was the place under the *hypæthron*. Here, under the open sky, stood the sacrificial altar mentioned by Pausanias, and the brazen urn which, according to the local tradition, marked the spot which Zeus had struck with his thunderbolt. The marble tiles which sheltered the opening in the roof over this spot have been found; and, further, the contrivance by which the rain-water that ran in here, and the oil that ran down from the statue, were carried away, has also been discovered. The vexed question has also been finally settled as to the position of the pictures painted by Panainos. It is demonstrable from the architectural remains now discovered that these pictures were placed on those three sides of the *impluvium* not occupied by the representation of Zeus, and that they were fixed within finely-ornamented bars. The Heraion, the oldest of all the Greek temples still preserved, has likewise been brought nearer to completion by supplementary discoveries. It has already been reported that its entablature and columns were originally of wood, and that the columns were afterwards replaced by stone. Now, in addition to the roof of semicircular tiles, with its antique spouts, frontal tiles, and gable crowns, there have been found several pieces of a terra-cotta covering, designed to protect the wooden cornice against the influence of the weather. In regard to form and decoration, these terra cottas, which apply the rosette in various forms, stand unique amongst the rich collections of ancient architectural terra cottas. There is another ancient building in Olympia that forms the transition from wooden buildings protected with terra-cottas to the later stone buildings. This is the treasury which was built in the Doric style by the Sicyon city of Gela. In this, the wreathed cornices, although of stone, were, no doubt, in imitation of the older practice, with wooden structures, covered with terra-cottas. The box-shaped pieces were ornamented with plaited ribbon-work, and the iron nails with which they were fastened are still to be seen in the numerous blocks of cornice still preserved. Above this covering there ran round the entire building a *sima*, which was likewise of burnt clay, but which, instead of the usual lions' heads at the spouts, had discharge-pipes with plate-shaped leaf wreath at the mouths.

As this *sima*, strangely enough, was also fixed on the horizontal gable *geison*, we have here the naïve bizarre effect of all the members of the profile running up at the gable corners into acute angles. The ornaments of the covering of the wreathed cornice, as well as of the roof-gutter, are almost exclusively after geometrical models, and are in three colours,—black, white, and red,—which are still in an almost perfect state of preservation. The ground-plan of this treasury is also quite unique amongst the buildings of Olympia. In front of the almost-square *cella* there lay a very deep *pronaos*, having six columns in the front, and two and a half on each longitudinal side. The half-columns, which replace the ordinary *antæ*, are laid immediately against the wall of the *cella*. In the interior of the *cella* there are two narrow side naves, exactly after the manner prescribed by Vitruvius for the Tuscan temple. Indeed, generally the entire ground-plan of this treasury of the Gela citizens presents great similarity with the design of the Tuscan temple. The Eastern treasuries, through the inscription discovered last year on the temple of the Megareans, were identified with those enumerated by Pausanias; and in a similar manner, a short time since, was obtained a fixed clue to the names of the Western treasuries through finding the architectural inscription on the treasury of the Sicyonians. Thus it was found that what had hitherto been called the treasury of the Syracusans was really built by the Sicyonians. Pausanias mentions the thirty-third Olympiad (644, B.C.) as the date of its erection, and, according to the usual reading, adds that in the interior there were two chambers of bronze, in the Doric and Ionic styles respectively. Upon this statement the treasury of the Sicyonians was in all works on art-history described as the oldest building in which those two styles had been united. The treasury of the Sicyonians, which has now been discovered and proved to be such by the inscription, and which, in accordance with Pausanias's description, is the most western of all the treasuries, is, both externally and internally, constructed uniformly in the Doric style, and shows neither any division into two parts in the interior, nor any trace of a bronze covering on the walls. The passage of Pausanias in question must, therefore, be either read or translated differently. At the back of the treasuries built on a common terrace at the foot of the Mount Kronion, a large facing wall has been built intended to support the pressure of the terrace, which is on a higher level, and protect the various structures from the danger of being overwhelmed by a fall of soil. On this wall Herodes Atticus, in Roman times, carried the great aqueduct from the Upper Alpheios valley to Olympia. The grand *exedra* found in the second year of the excavations forms the monumental termination of this work.

Of the buildings in the interior of the Altis which have received important supplements from the latest researches, the entrance-gate to the sacred enclosure of Pelops may be mentioned as the latest. This is a structure after the manner of the inner propylæa of Eleusis. Judging by its style, it belongs to the fifth century before Christ. The later excavations undertaken to find the old festival gate of the Altis have revealed the lamentable fact that in late Roman times it was demolished and replaced by a large triumphal gate on the south-east. This itself has likely entirely disappeared, except the foundations. Separated from this by a narrow road, there lies to the east the so-called Leonidaion, which was erected by the Romans on the stylobate of an old Greek edifice. In this Leonidaion the governors of Achaia used to reside in the time of Pausanias. It was erected, according to an inscription found on a leaden pipe, in the reign of the Emperor Nero. In the month of November last it was discovered still almost complete, and in addition to the atrium and tablinum, which were already known, there was found a fine peristyle, with several adjoining apartments. North-east of the Leonidaion there lay, parallel and near to each other, the hippodrome and stadion. They occupy almost all the eastern side of the Altis. Excavations are still going on in the hippodrome with a view to determine its position and limits with greater precision. Of the stadion, the starting-point and goal, the beginning and end, have already been laid open. Between the starting-point and finishing-post the distance is, according to exact measurement, 197·27 mètres (or about 647 ft. English). This is, therefore, the precise length of the Olympic stadion or course, the most important of all measures of length for Greek antiquity. The Olympic foot was the six-hundredth part of the stadion course, and therefore measured 0·3205 mètre, and was therefore nearly an inch longer than an English foot, according to this measurement. The measurement now ascertained of the Olympic foot agrees exactly with the foot as measured on the various buildings of Olympia. On the southern boundary wall of the Altis outside the sacred enclosure two buildings have been found belonging to the Greek era. They are next to the Bouleuterion, but their purpose is unknown. The large buildings in the western part of Olympia, which for almost 500 mètres fill the space between the Altis and the Kladeos, have now for the most part been laid bare. The most southerly and the grandest edifice of the number was hitherto regarded as a gymnasium. But since the foundations have been opened it is found that within the inner colonnade there was no wrestling or running ground, but large water-basins and groves or shrubberies, so that the conclusion is that it was not a gymnasium. Nor can any clue to its character be found, as Pausanias, in spite of its size, has not mentioned it. Towards the north lie various edifices grouped around the ancient stylobate of the Byzantine church. The small rotunda-like edifice turned to the west, in which an altar of earth covered with stucco was found, appears from the inscriptions on the altar to have been an *Heroon*. The other buildings in this group seem to have been the dwellings of priests, called by Pausanias the *Theokoleon*. These edifices were connected directly with the Altis by a small gate; the other buildings further to the north form the gymnasium establishment mentioned by Pausanias. In their arrangement they agree almost entirely with Vitruvius's description of a Greek gymnasium. First to the south comes the palæstra, with the wrestling-grounds, the colonnades, auditoria, and bathing-rooms; then, contiguous to the north, the race-course in the open air for use in summer, and a double-paved *xystos* or colonnade, a stadion long, for running exercise in winter. At the present moment further excavations are going on to the north of the Altis to find the theatre mentioned by Xenophon. Hitherto this search has been without result in discovering that object, but it has led to the finding of many architectural remains belonging to one of the treasuries, so that six of these edifices,—most of them belonging to the sixth century B.C.,—have now been sufficiently recovered to admit of being represented pictorially. Among the results of the late excavations, there have been found seventeen capitals of the Heraion, most of them very old, and thirty-two various kinds of Doric columns of the ancient Greek and Hellenistic periods, representing almost the same number of ancient edifices. The collection of plastic and painted terra-cottas of an architectonic nature comprises over a hundred different varieties. These are of great importance not only for the history of the development of Greek architecture, but as aids for modern art-industry, especially for the terra-cotta manufacture.

DEATH IN THE AIR.

THE occurrence, within the past few weeks, of a remarkable number of fatalities from an unusual if not a wholly novel cause, demands our serious attention. It does so mainly for the reason that the wrong lesson will be drawn from the facts by at least nine persons out of ten. We refer to deaths by asphyxia, or rather by gaseous poisoning, in the bath-room. At one inquest lately held on a case of the kind, the medical man who gave evidence said that it was the sixth case which he had attended within a few days, four of which had proved fatal. It is clear, therefore, that the matter is urgent.

The first impression which will be produced on many, if not most, people who are told of these occurrences, will be, that in substituting gas, or improved means of burning other fuel, for the old-fashioned open fires, we are shunning Scylla to fall into Charybdis. "We know the worst of the old plan," they will say; "it is costly,—wasteful, if you like,—and no doubt produces smoke; but better pay what we pay, and be smoked as we are smoked, than be smothered outright. Let improvements be made by those who have time or education to attend to them: we will stick to the old plan. At all events, we know the worst of that."

There can be no doubt that there is truth, though not the whole truth, in this view. It is one which we have so far anticipated in these pages as to call attention to the fact that the nursery is the last room in the house in which the open fire should be abandoned. The argument, it is true, is one from ignorance; but when the ignorance is profound, inveterate, and widely spread, that remark loses its force. The whole labour of the sanitary reformer is a crusade against ignorance. The only two foes with whom he has seriously to contend are ignorance and negligence. And at present they win the day, nine times out of ten.

But these bath-room deaths, rightly regarded, are only so many striking proofs of the truth of what we have before indicated as the law of combustion. Economy and health are to be pursued together, by attention to this law. The law in question is, that for all artificial combustion, the due quantity of atmospheric air should be admitted to feed the flame, and the products of combustion should be removed, and not allowed to escape into the dwelling-house. This, we have before said, is best done by a closed circuit. But with an enclosed circuit, in which either light or heat is produced in the most economical manner, must be combined an arrangement for ventilation. If the fumes of the mineral fuel are removed by its own chimney, the fumes from the slow combustion in the human lung must be removed by another channel from the apartments.

Many convenient methods are now in use for heating baths by gas. Of the great convenience, and thus true economy, of the process, we have before now spoken. But we have always insisted on that which the sellers and purchasers of gas-burners and stoves leave out of sight. The purchaser has no warning of the danger he encounters. Do we not see, in every ironmonger's shop, stoves which are recommended for use as being without chimneys. They are so convenient,—so economical. Yes, and, it should be added, so deleterious to health, so likely to prove fatal. And it is probable that the more economical the stove, the longer it goes on burning without replenishing, the greater is the proportion of carbonic oxide that it produces; that is to say, the more are its invisible fumes not only suffocating, but poisonous.

We desire, therefore, most strongly to urge upon all whom our words may reach that if they are not themselves engineers, or persons tolerably familiar with the theory and practice of combustion, they admit no stove, heater, or burner into their house except under competent advice. That advice, we need hardly say, should not be that of the tradesman who supplies the stove. Good as his advice might be, the fact that he is a party interested in the matter is alone enough to preclude him from taking the position of an adviser. Some one who knows what combustion is chemically, and what the human lungs are physiologically, should be consulted. Many medical men, many architects, surveyors, engineers, might give good advice. But let the man who wants to live, and to rear children or to keep a healthy household about him, remember that any man who tells him that it is quite safe to use stoves without chimneys, or to burn gas freely in the air of the dwelling-chamber, is an ignorant, and therefore a treacherous, adviser. And, more than this,—that to follow his advice is to run a deadly risk.

THE LATE MR. E. H. CARSON, ARCHITECT.

THE remains of this gentleman, whose death took place some days ago, at his residence, 25, Harcourt-street, Dublin, were interred at Mount Jerome Cemetery, on the 16th inst. Mr. Carson was a pupil of the late Mr. William Deane Butler, an architect of some note in Dublin a generation since. The deceased gentleman for several years enjoyed a tolerably fair practice, and designed some public buildings and many private dwellings and villa-residences in the city and provinces. Among the former were the restored or rather rebuilt parish church of St. Peter, Dublin, and the Town-hall of the Pembroke Township, in the same city. Mr. Carson for the last few years was a member of the Dublin Corporation, as well as being a Commissioner of the Pembroke Township from its first formation. His funeral was attended by several of his brother architects, and by the leading representatives of various classes in Dublin.

ST. MARK'S, VENICE, AND THE ACCADEMIA DI SAN LUCA.

ALL those who have followed with any interest the vexed question of the restoration of St. Mark's will recall the position,—in so far as regards our interference,—which the affair has assumed; the meeting held by the Preservation Committee in the middle of January last; and the letter subsequently sent to the Roman Academy of St. Luke by Mr. Wallis. This letter the President of that ancient and respected Society* has, we learn, recently submitted to the Italian Minister of Public Works, accompanying the document with a letter of his own, expressing the entire sympathy of the Academy with the tone of Mr. Wallis's able summary of the views of the Preservation Committee.

The Roman journal, the *Opinione*, of the 14th of February, contained a translation *in extenso* of Mr. Wallis's letter,† and, what is of more concern to those interested in the question in England, a summary of the letter which the President of the Academy of St. Luke addressed to the Minister of Public Works.

The tone of Mr. Wallis's appeal will be remembered; the Academy of St. Luke entirely acquiesce, it would appear, with the view of the Preservation Committee in "this delicate question," as they very justly term the matter of the restoration of St. Mark's. The Roman Academy are particularly pleased to be entrusted with the task of presenting the letter to the Italian Government, as this apparent interference coming from a foreign source they feel will not be received in the same spirit as if addressed from home; the step, in fact, as the President happily expresses it, loses not a little of its harshness, and partakes of the nature of a friendly counsel, a warning transmitted by a sympathetic acquaintance, and, as the President very justly further points out, in such a spirit the action of the Committee was alone conceived, an action which, in the most cordial terms, expresses all the gratitude and love which foreign artists profess for the land of their studies and their artistic education.

It cannot be denied,—the tone of the letter continues,—that however far the Italian Government may be free from blame, the fears expressed concerning St. Mark's were justified. If monuments of this importance belong by right to the nations of which they are the natural property, it is none the less equally true that morally they belong to the whole civilised world, by which they are regarded as affording not alone a continual source of instruction, but as representing a glorious link in the chain of artistic tradition. It is from this point of view that the Academy of St. Luke support the interference of the Committee; they recognise the right of every foreigner to raise his voice when he sees such revered monuments menaced.

* The Academy of St. Luke was, if we mistake not, definitely constituted in 1595, on the foundation, however, of an association of a much greater antiquity.

† The translation is admirably correct in all but a very minor, and, if anything, probably more amusing than serious point. English titles and honorific distinctions have, it must have been often observed, a singular power of puzzling foreigners; but we should have imagined, not only that the name of Mr. G. E. Street would have been familiar enough to an Italian acquainted with English, to prevent him from referring to "Sig. G. E. di R. A. Street," but that the meaning of the much-coveted initials (the cause of the mistake) would have been known to him; we pass over *Buckingham Sr.* (*sic*) *Stram* (*sic*) as attributable probably to the compositor.

HOMEFIELD, MERTON.

THE two views (exterior and interior) which we give in our present number, illustrate a portion of the alterations and additions recently made to this residence, comprising chiefly the construction of a central hall opening to the staircase, with a stone arcade, the erection of a new wing containing a drawing-room, with guests' rooms and boudoir over, the re-modelling and re-erection of the conservatory in a new position, and various alterations and additions to the kitchen and domestic offices.

The hall is panelled the whole height in woodwork, the decoration of the panels resembling "Tarsia" work, the ceiling being also panelled, and having moulded beams with pendants at the intersections.

The general effect of the decoration is a golden brown, the floor is of marble mosaic, and the stonework and steps, and shafts are of red Mansfield stone and Belgian "T" grey marble, the windows being filled with stained glass. The chimney-piece, in red Dumfries stone, deeply recessed, moulded, and carved, and having a carved and traceried hood in wainscot, running up to the ceiling cornice, with a central painting (by Weekes), forms a picturesque feature.

The lower portion of the staircase has been reconstructed, and now faces the hall, a screen, with carved and moulded shafts bearing a cusped arcade with carved spandrels, being carried across the entrance vestibule; the newels to stairs are also moulded and carved, having between them pierced and carved panels. The wall-surfaces of the staircase are decorated in tones of blue, the woodwork being black.

The drawing-room is panelled to a height of about 8 ft., finished with a moulded and embattled cornice. The architraves to doorways are enriched with carved beads and moulded shafts, carrying coved heads with moulded ribs, open baluster work, cresting, and pendants.

The ceiling has a geometrical setting-out of plaster ribs with enriched pendants at the intersections, and a frieze in low relief, and the floor has a central filling of French oak, "herring-bone," with a border of wainscot, walnut, and ebonised pear-wood.

The present scheme of colour is kept light, but low in tone, with some gold, increased richness being intended to be given later on by the painted frieze and the introduction of figure subjects,—possibly illustrative of some poem or legend,—in the panels, in colour on a gold ground.

Externally the work is executed in old brickwork, red Mansfield stone, and brown tiles, the roofs of the turrets and all the finials being of copper; the barge-boards are moulded and carved, and all the mullions and woodwork to the windows, turrets, &c., are fully moulded.

The general contract work was carried out by Mr. Geo. Amer, builder, of Catford, and the whole of the decorative and art work generally by Messrs. Harland & Fisher, who also executed the stained glass and the marble mosaic pavement; Messrs. Strode, Turpin, and Tagnon respectively providing the gasfittings, parquet, and marble work; the whole being executed from the designs and under the superintendence of Mr. Alfred Jowers, architect, of Gray's Inn-square, London.

LIVERPOOL INSTITUTE.

A DESIGN FOR THE NEW SCHOOL OF ART.

THIS building, the subject of a recent competition, as our readers are aware, is to be erected on acquired ground contiguous to the Institute, the present rooms being found inadequate to the purpose.

The design illustrated in the present number was prepared to meet the requirements embodied in the instructions, supplemented with various arrangements and additional apartments which the author, aided by experienced artists, and a visit to the South Kensington Schools, considered necessary to the efficient working of the institution.

The task imposed on the contributors in this competition was by no means an easy one, the great difficulty being to arrange the studios so that they should all have north light, except the elementary rooms, which do not absolutely demand this aspect. Not only is a northern light necessary, but the windows should, if properly designed, be continued past the wall-plate on to the roof,—this for general use of painters, decorators, &c.,—the light for sculpture being preferred, by professors of the art, from the top or skylight. The clumsy contrivance of cutting away the head of the window, as may be seen in many old houses in London, and in Church-street, Liverpool (where Philip Westcott wielded the brush) was discarded by the author for the more legitimate method of openly showing the proper construction, endeavouring at the same time to render this somewhat peculiar but necessary feature satisfactory to the eye. The cornice is stopped to allow the window transom to connect the wall with roof lights; *vide* Instructions issued by the Science and Art Department, which says,—"the painting-rooms should be lighted from the north side, and should have a top light in the roof over and in continuation of the side lights."

Here was an opportunity for a little originality in design, arising out of the natural requirements of the artist, and the attempt has been made to grapple with the difficulty, the author believing the result would justify the endeavour, rather than design an elevation which might suit a bank or any other purpose, merely cutting away the upper part of a few windows to fit it for an Art School!

An important saving in cost would follow the mode here proposed, as the building is not required to be so lofty, and in this particular instance the lower the building is kept, the better (the same may be said respecting the pitch of roof), as the Institute is some feet below the proposed Art School, and the former will suffer considerably by comparison in any case.

In the absence of sections, it may be stated that the second antique and masters' rooms are lighted from the north above the corridor with roof-light same as the others.

There are two entrances; the principal one is in Mount-street, the other in Hope-street, to be used by female students and those attending the lectures, a room for that purpose being introduced on the upper floor. It was likewise thought desirable by the authors to arrange the chief studios as nearly as possible *en suite*.

Rooms for cleaning boards, straining paper, with receptacles for modelling-clay, and a lavatory adjoining the modelling-room (a most desirable arrangement for cleanliness), also a lift for raising casts, &c., are provided in this design.

The materials for the elevations were proposed to be Storeton-hill or other approved freestone for dressings, with light red pressed bricks for facings.

The style of the period of Francis I., being well suited for an art-school, was adopted for the freedom of treatment of which it admits, a large amount of characteristic sculpture and carving being introduced to make the building worthy of the "Florence of England."

This design (under motto "Ars") was submitted by Mr. Edward A. Heffer, of Victoria-road, Kilburn, and formerly of Liverpool.

THE CHURCH OF SAN ESTÉBAN, SALAMANCA.

ABOUT the year 1221 the monks of the Dominican Order of Salamanca were in the possession of the Church of San Juan el Blanco. Shortly afterwards they established themselves in the parish of San Estéban, by permission of the chapter of the cathedral church. In 1512, however, two brothers of the Dominican Order founded the present convent and its costly church; carrying out the desire of the whole community of Salamanca. Those two personages were Fr. Domingo de Soto, professor of Salamanca University, an eminent divine, and Fr. Juan Alvarez de Toledo, at that time bishop of Cordova, and son of the well-known Duke of Alba.

Maestro Juan de Alava, whose reputation had already been established by the cathedrals of Plasencia, Seville, and Salamanca, of which he was the architect, was entrusted with the preparation of the designs for the Church of San Estéban; and the works were commenced on the 30th of June, 1524, and concluded on the 18th of February, 1610, on which day the new church was consecrated.

We give an exterior view of this singular building, in which Gothic forms are largely mixed up with those of the Renaissance. Here the Dominicans hospitably entertained, for some time, the discoverer of America.

A Spanish writer says:—"It was a remarkable incident in the life of the illustrious monk, Fr. Juan Perez de Marchena, to meet with a man who, with the intention of undertaking such a gigantic enterprise, appeared at the doors of the convent and begged for bread and water in the name of the Lord. The monk insisted on his becoming his guest for a time, and, not placing sufficient confidence in his own individual judgment, called in the aid of the illustrious Garcia Fernandez, a medical man of Palos, and of Pedro de Valesco, an old and experienced pilot, to attend to the mariner."

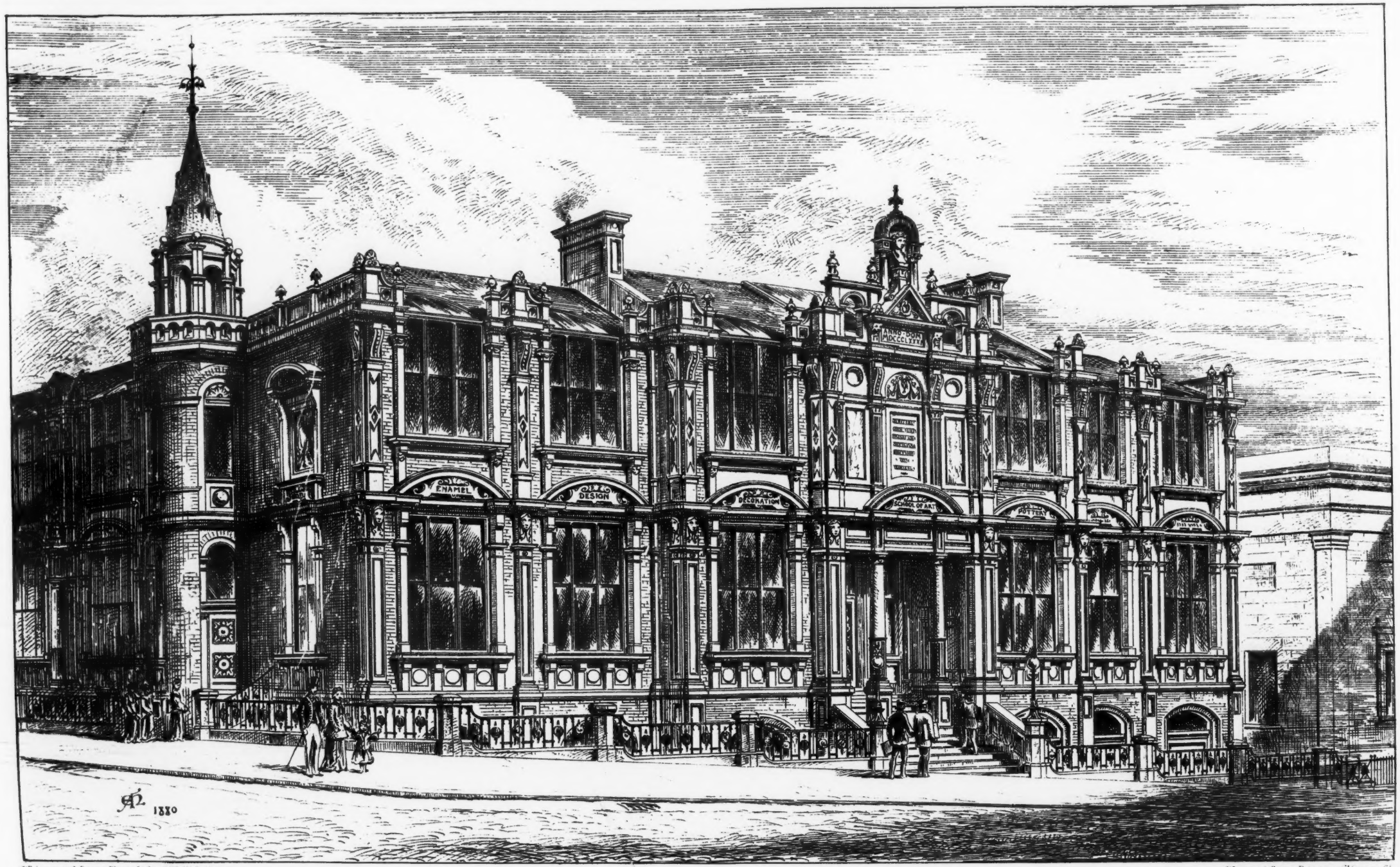
Tradition has not marked the cell which housed Christopher Columbus; nor even the locality where the conferences of the council of doctors were held. There still exists the "Salon de Profundis," a hall for reading prayers for the dead, an immense room, to which a feeble light is admitted through a window at the back, and it is said that in that hall Columbus first disclosed his project to the congregation of Dominican monks.

Whiteman & Bass. Photo-Litho. 236, High Holborn.

HOMEFIELD, MERTON: ALTERATIONS AND NEW WING.

Wyman & Sons, Printers, 74 Queen St.

ALFRED JOWERS, ARCHITECT,
7, GRAYS INN SQUARE, W.C.
LONDON



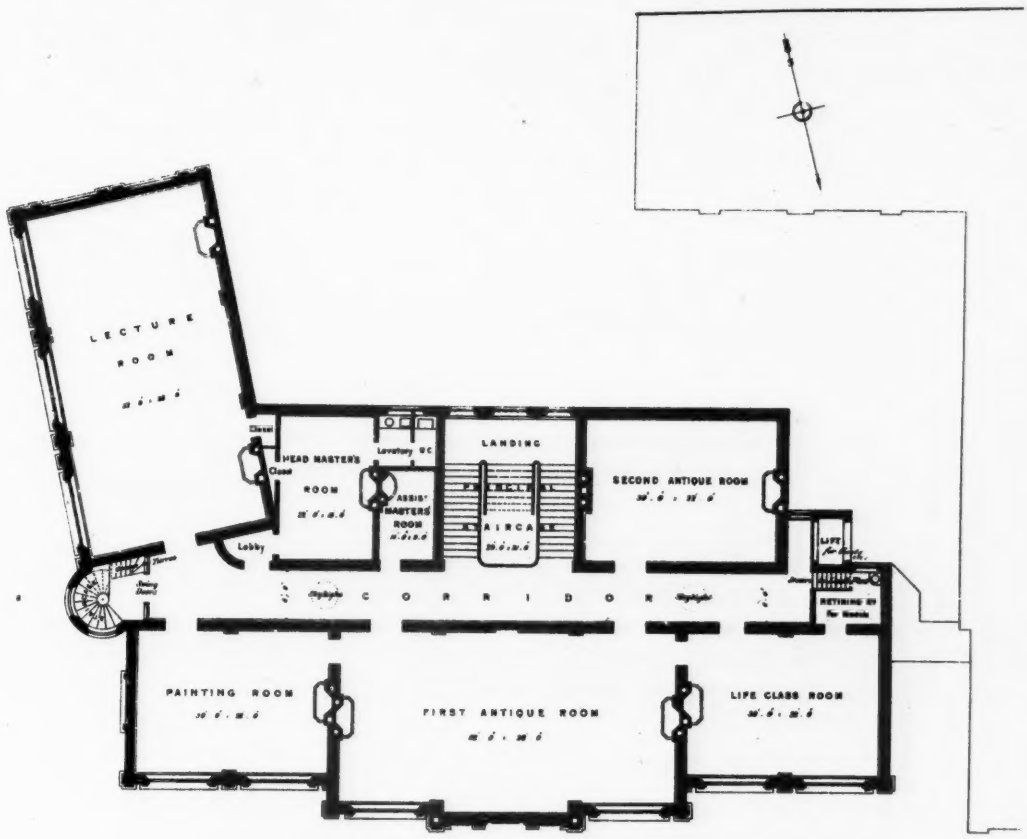
Whiteman & Bass, *Photo-Lith.*, 236 High Holborn

Wyman & Sons, Printers, 74 Queen St.

A DESIGN FOR THE PROPOSED LIVERPOOL SCHOOL OF ART.—By Mr. Edward A. Heffer, Architect.

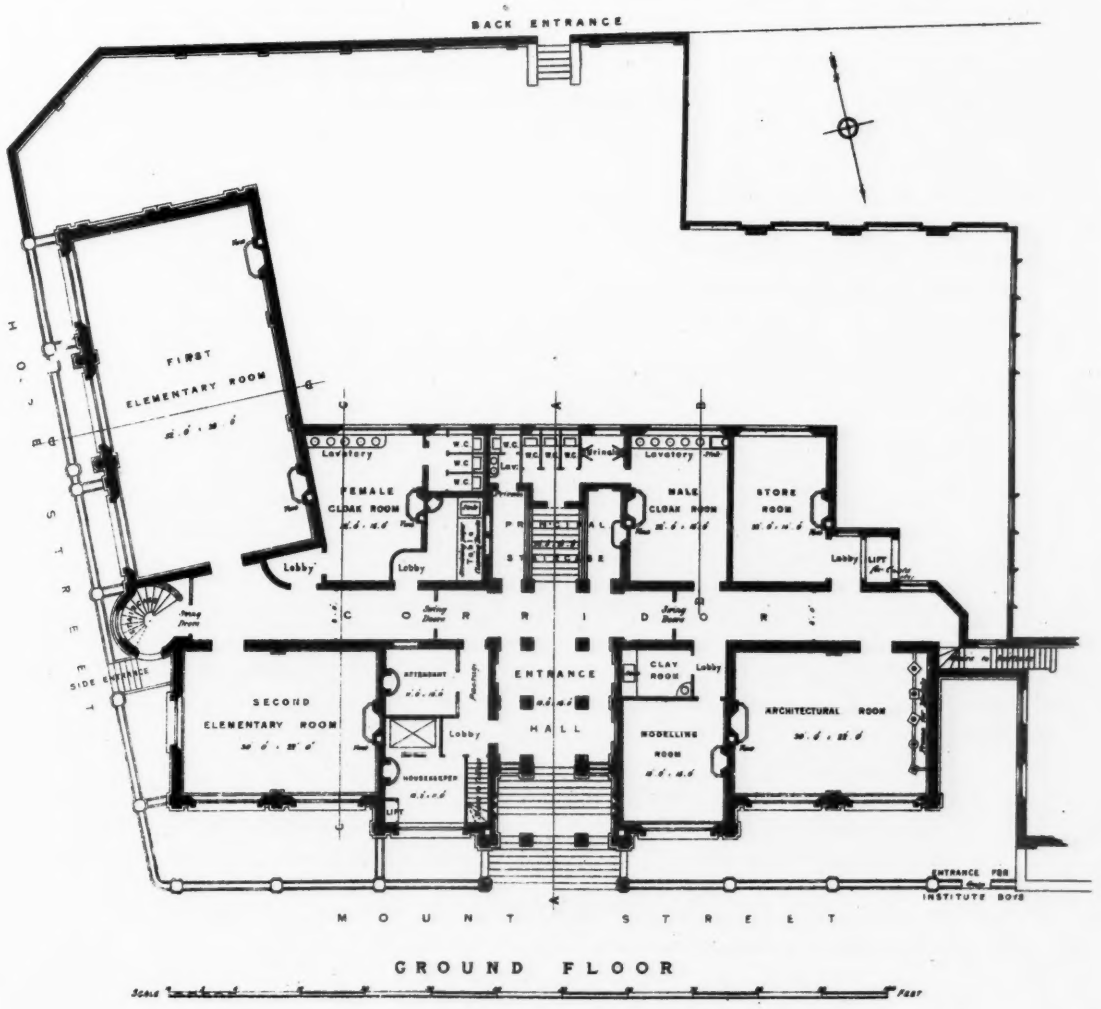
THE CHURCH OF SAN ESTEBAN, SALAMANCA.——A.D. 1524 TO 1610.

Whiteman & Ba



FIRST FLOOR

Scale [illegal] Feet



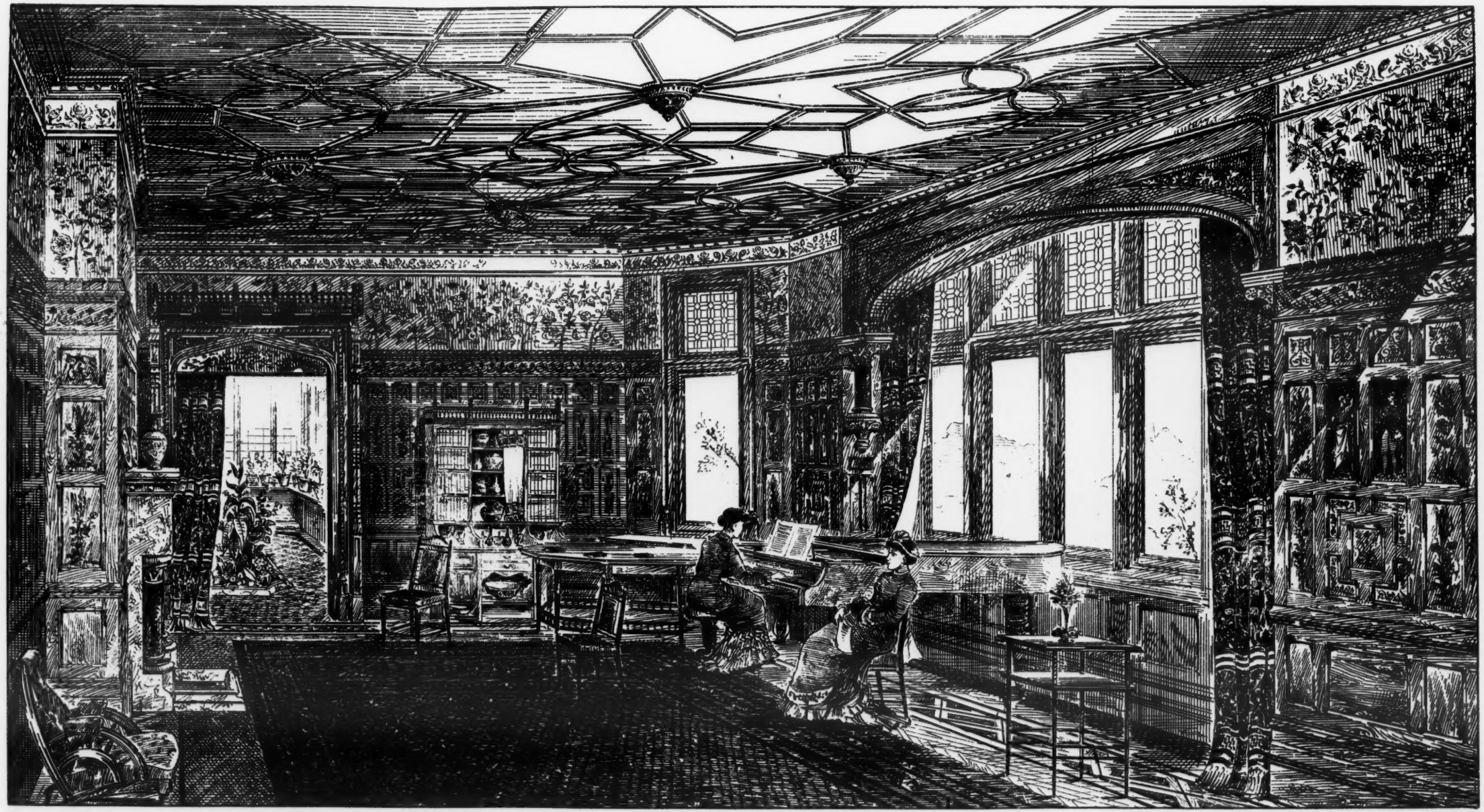
GROUND FLOOR

Scale [illegal] Feet

A DESIGN FOR THE PROPOSED LIVERPOOL SCHOOL OF ART.—*Plans.*

Whiteman & Bass, *Photo-Litho.* 236, High Holborn.

Wyman & Sons, Printers, C^t Queen S^t



Wyman & Sons, Printers, Gt Queen St.

HOMEFIELD, MERTON: THE DRAWING-ROOM.

ALFRED JOWERS, ARCHITECT

AN EXCURSION IN LOMBARDY.

ARCHITECTURAL ASSOCIATION.

AT the ordinary fortnightly meeting of this Association on the 18th inst., Mr. Ernest C. Lee, president, in the chair, the following gentlemen were elected members, viz., Messrs. H. B. Thorp, J. E. Kingham, G. Maides, J. Holdgate, W. J. Hilton, J. U. Quick, T. W. Abbott, R. D. Hawes, and F. Slaiter.

On the motion of Mr. Eales, a vote of thanks was given to Mr. T. Roger Smith, the architect of the new North London Hospital for Consumption at Hampstead, for accompanying some of the members over that building on the 12th inst. We gave view, and plans, and description of the building not long ago. It was announced that on this Saturday, the 26th, a visit would be paid to a new Board School on the Queen's Park estate, Harrow-road.

Mr. E. J. Tarver, past-president, then read a slight sketch of the Association's excursion in Lombardy. The excursion was organised by Mr. Hugh Stannus, with the view of introducing some of the members to Renaissance architecture on its native soil. The party numbered twelve, and was enabled, thanks to the arrangements made by Mr. Stannus, to see a great deal in a very short time. Starting from London early in the morning of the 15th of September, the party arrived in Paris on the evening of that day. They remained in Paris until three in the afternoon of the next day, when they started for Turin,—a thirty hours' journey,—*viâ* the Mont Cenis Tunnel, in which Mr. Tarver fancied he detected "a warm smell like that of a wine-cellar." Arriving in Turin late in the evening of the 17th, they spent the next day up to eleven o'clock in strolling about the town. Among the buildings visited by some of the party was the huge Jewish Synagogue, with its enormous curved and truncated roof,* square on plan, and its numerous superimposed orders of columns. At half-past four the same day the party arrived at Milan, where they had frequent occasion to pass through the Galleria Vittorio Emmanuele,† a gigantic promenade roofed with glass at a height of about 80 ft., and containing the fashionable shops and restaurants. The architect of this building, Signor Mengoni, met his death by falling from the scaffold. To think of this grand central feature of the town, said Mr. Tarver, made one feel ashamed of our contemptible little covered arcades in London, and made us wish that Trafalgar-square might be turned to account in a somewhat similar manner. Such a covered space need not, indeed, be so high as to conceal the view of the National Gallery, and there was certainly no fear of its eclipsing the Nelson Monument. The fountains would add a charm that the Milanese promenade lacks, and it seemed to him that two covered promenades crossing diagonally from the terrace steps to the opposite corners of the square, with an octagonal space in the centre, would form a pleasant short cut, especially in rainy weather, from the Grand Hotel to Pall Mall, and from Cockspur-street to St. Martin's-lane. The Galleria Vittorio Emmanuele leads from the square in front of the Scala Theatre to that in front of the cathedral, called the Piazza del Duomo. Here, again, the English visitor sees an amount of elbow-room that makes him feel thoroughly ashamed of our crowded spaces. Here the omnibuses draw up, not behind one another, with constant cries of "Draw up higher, can't yer!" as here, but with their doors towards the pavement and a flag on each which showed its destination. Imagine the convenience of this arrangement, instead of having to rush, and crawl, and jostle in trying to approach our omnibuses at the imminent risk of being run into or run over by another omnibus behind one's back. The exterior of Milan Cathedral was seen by the party by moonlight, and, said Mr. Tarver, if anything could give it a chance of looking well, it should be by moonlight, but even thus it looked a frivolous wedding-cakey affair. The party stayed in Milan on Sunday the 19th, and visited a goodly number of churches, besides visiting the Brera, which contains the picture-gallery and museum of sculpture. The gallery is rich in frescoes by Luini. The gem of the collection is Raffaelle's picture of the "Marriage of the Virgin." A good look was given to the Church of Santa Maria presso San Celso, by Bramante. The east end of this church is apsidal, with an ambulatory. The planning of this feature is as "dodgy" as any Gothic work could hope to be, yet the effect is as quiet and sturdy as the severest Classicist could desire. So far as Mr. Tarver had been able to judge, Bramante seemed to have treated Renaissance architecture with just the proper amount of playful freedom, and no more, and to have worked well within his power. Alberti's work seemed, in comparison, quite "stodgy," and that of later men, with its twists and curves, both in elevation and plan, quite licentious; but Bramante, especially in his stone architecture, exhibited quite enough fancy to show that his work must have been a pleasure to him. On Monday, the 20th, Mr. Stannus "piped all hands" to measure the Church of St. Satiro, and the party left the same morning for the Certosa. The church was partly under repair, so that the visitors were unable to examine some portions. They thought the west front a shocking bad composition architecturally, but what did that matter when one could revel in every portion of the detail? It is a sort of west front to examine in a self-propelling Bath-chair, moving one's self slowly about from one point to another, and taking several weeks over the job. What delighted Mr. Tarver most in the choir were the backs of the stalls ornamented with wood inlay, said to be designed by Borgognone. What a good thing it would be to pack off a few dozen of the young gentlemen who draw stained glass and other decoration to study this work! On the morning of Tuesday, the 21st, the party divided into ones and twos, and rambled about the city of Pavia. The unfinished cathedral, designed by Bramante, is most instructive. Good luck led Mr. Tarver to the Church of St. Theodore, which contains some fine frescoes on the north and south walls of the transept. Taking train the same day, Mantua was the next halting-place, which was reached after dark. On the following morning, the Church of St. Andrea, one of Alberti's works, and the Palazzo, were visited. Leaving Mantua at 8·45 on the 22nd, the travellers arrived at Verona at 10·30 the same evening. On Thursday, the 23rd, they started for San Zenone, an outlying church of the twelfth century, and so beautiful in its quiet simplicity that the mind reverts gratefully to it through the daze of all the Renaissance work that the excursionists saw in the course of their trip. At San Bernardino there is a circular baptistery called the Capella Pellegrini, by Sanmichele. After seeing the cathedral, the party crossed the Adige to see the Church of San-Giorgio, an oppressively grand design. It contains an altar-piece, representing the martyrdom of St. George, by Paul Veronese. After visiting other churches, the travellers took train for Brescia, where they arrived the same evening. Friday, the 24th, was the last day on which the members of the party were to be together, and in the town of Brescia they were to fulfil one of the chief purposes for which they had travelled to Italy, viz., to secure a monograph of Sta. Maria dei Miracoli. Reserving that *bonne bouche* for the afternoon, they spent the morning in visiting the two cathedrals, new and old, which stand side by side, and are connected by a passage. After dinner the party split up, five going on to Venice, and the others returning to England at the time laid down in the prospectus, and after an expenditure per man within the sum named by Mr. Stannus.

Mr. G. Crickmay, jun., followed with a brief paper describing the visit of some of the party to Venice, starting from Brescia, and proceeding viâ Padua. He urged that the Association would do well to arrange for an excursion to Venice on a larger scale.

A brief discussion followed, in which the President, and Messrs. Longden, Gill, Phené Spiers, and Stannus took part, and a cordial vote of thanks was given to the readers of the papers and to Mr. Stannus, the latter gentleman suggesting that the excursion of the Association might very usefully be made, every alternate year, on the Continent. The excursions hitherto made by the Association had been somewhat one-sided in their scope. Beautiful as was so much of the Gothic work, he thought it was possible to derive instruction from the examination of the best work of the Renaissance.

At the next meeting of the Association, to be held on the 4th prox., Mr. William White, F.S.A., will read a paper on "Cheap Churches."

* Illustrated in *Builder*, vol. xxxiv. (1878), p. 857.
† Illustrated in *Builder*, vol. xxvi. (1868), pp. 299, 491.

LECTURES AT THE PARKES MUSEUM OF HYGIENE.

WATER-CLOSETS, SINKS, AND BATHS.

THE fifth and last of the series of lectures to members of building societies on the construction and maintenance of healthy dwelling-houses was delivered on Saturday afternoon last, at the Parkes Museum of Hygiene, by Professor W. H. Corfield. Treating of water-closets, sinks, and baths, the lecturer commenced by referring to the common "hopper" closets, which were difficult to flush and keep clean. Upon them a variety of improvements had been made, such as was seen in the "Artisan" closet, in which the basin was of an improved shape. Hellyer, Sharpe, Brasier, and other makers had also improved upon the hopper closet. What were called wash-out closets were all improvements on the hopper closet, and all of them, in common with the latter, possessed the merit of non-liability to overflow, and of being usable for the pouring away of slops. Of wash-out closets perhaps the latest introduced was that known as the "Shrewsbury," devised by Mr. William White, well known as an architect. In that closet the chief peculiarity lay in the means of flushing, which consisted of a sort of scoop or tilt-up cistern fitting inside the small closet-supply cistern. The pulling-down of a handle attached to a chain connected with a lever caused the inner cistern to tilt up and discharge its contents with rapidity and force into the closet-basin, through a pipe of larger diameter than usual. The "Carmichael" closet, with a flushing rim and a ventilating-pipe, and other closets of a similar kind, were improvements on the old hopper closets. The best trap for a hopper closet, as, indeed, for all closets, was a S or P, as such traps allowed of no deposit of foul matter. Of "wash-out closets, he believed the first was Jennings's "Monkey" closet, in which, as in all other wash-out closets, the aperture for discharging the contents of the basin was not at the bottom, but at the side. Since the "Monkey" closet was introduced a variety of others had been brought forward, such as Bostel's "Brighton Excelsior," Dodd's, and others. The lecturer strongly condemned "pan" closets, the iron containers of them being mere receptacles for the retention of filth and the accumulation of foul air. He believed that attempts had been made to improve the pan-closet, by causing the interior surface of the container to be washed every time the closet was flushed. The means which had been tried had consisted in inserting a water-pipe into the interior pierced with a number of holes for the discharge of water, which played all round the interior surface of the container. That device had not, he believed, proved to be successful. Means had also been adopted for ventilating the container by inserting ventilating-pipes into its upper surface, but with little or no success. The containers of some pan-closets were purposely made with openings in them for ventilating-pipes, but plumbers had been known to fix the pan-closets without either affixing such pipes, or plugging up the holes made for them, being apparently in ignorance of the purpose which the openings were intended to serve. As though the container of the pan-closet were not in itself a sufficient depository of filth, it was generally used in conjunction with a lead ⊍-trap, which could never be thoroughly flushed out in ordinary use. One merit which the pan-closet possessed was that it could be used for pouring away slops, and was not liable to run over, supposing the water-valve to be leaky or carelessly left running. Valve closets, which were provided with a water-tight valve which had to be opened to allow of the contents of the basin being discharged, were provided with a special contrivance for taking any overflow. Bramah's was the first valve-closet introduced, but there had been various improvements upon it, notably by such makers as Tylor, Jennings, Doulton, and Bolding. However good might be the closet used, it should never be in connexion with a ⊍-trap, but should have an S or similar trap capable of being thoroughly flushed each time the closet was used. With regard to water-supply to closets, it should never be directly from the cistern supplying the drinking-water of a house, but from a small intervening cistern, such intervening cistern being a special necessity where the water was supplied on the "constant system," for a supply-pipe leading from the main should never, on any account, be carried direct to a water-closet pan. Although such a

practice was contrary to the bye-laws of the water companies, it was resorted to far too often. It was fraught with the utmost danger to the health of the public, for should the water be temporarily turned off at the service reservoir or in any section of the mains concurrently with the valves of water-pipes supplying closet-pans directly from the main being left turned on, a process of suction was likely to be set up by the empty mains, and foul air from the closet-pans (of which, in a large city, a large proportion were always kept in a very dirty condition) would be drawn into the mains, and would pollute the water when it came into them again. A serious epidemic of fever in Croydon had been clearly traced to this cause. The water-pipes from cisterns supplying closets should always be charged with water, the valve for admitting it into the pan being under the seat. The old-fashioned wires, cranks, and spindle-valves should be entirely disused. They were continually getting out of order, and if the cistern were placed very high above the closet which it supplied the water took some little time in finding its way down the pipe. In conclusion, the lecturer dwelt on the necessity for the disconnexion of soil-pipes from the drain and for their ventilation, and described the simplest means of attaining these ends. He also showed the necessity of disconnecting waste-pipes from sinks, baths, and lavatories, and overflow-pipes from cisterns, water-closet pans, and safes beneath water-closets. Some of the fearful examples of old and bad plumbing-work which the Museum contains were shown as illustrations of "how not to do it," the most flagrant one, a *zinc* ⊔-trap, with zinc soil-pipe and waste-pipes leading into it being, perhaps, the *ultima thule* of "scamped" work in this branch of the building trade.

The lecture was very numerously attended and at its close a vote of thanks was given to Professor Corfield, reference being made by the mover and seconder to the value of this course of lectures (all of which have been reported in the *Builder*) to members of building societies, for, it was observed, a very large proportion of building societies' property was in a very insanitary condition.

SANITARY SCIENCE IN ITS RELATION TO CIVIL ARCHITECTURE.

CONTINUING our report of the renewed discussion of this subject at the Royal Institute of British Architects,*

Mr. J. P. Seddon, Fellow, said that architects could not but rejoice at the sanitary crusade now in progress, trusting that some good might result from it to the community. He welcomed the interest recently shown in the matter by the members of the medical profession, as the public would listen to them, though long deaf to architects, who had piped much longer in the same strain. He wondered whether such learned gentlemen would be surprised to hear that a discussion upon the practical ventilation of buildings was held in this room of the Institute of Architects in the year 1863. A glance at the remarks then made would show that architects were even then alive to the grave importance of the subject. The speaker, having referred briefly to questions of drainage, afterwards quoted some remarks he had made during that same discussion, which took place several years previously to Mr. Tobin's alleged discovery (see "Transactions," 1862-63, p. 132). He would summarise his views by asserting that it was as necessary to lay on air to houses as water, and that by other means than the soil-pipes, which in nine houses out of ten were the only pipes that admitted air when the windows were shut. Further, that the fireplaces were the best places for its admission. Even from the Tobin tubes the cold air admitted often made a short cut to the fire, and in its course annoyed the inmates of a room. Nevertheless, he acknowledged the debt due to Mr. Tobin, who had gained the public ear where others before him had failed. Mr. Seddon concluded by referring in laudatory terms to "The Wonderful Grate," the very existence of which he said had been doubted by his friend, Mr. William Burges, A.R.A.; and he begged leave to show a model of it lent to him for the purpose by its inventor, Mr. Samuel Russell.

Mr. Samuel Russell, having been called on by the President, enumerated the special properties of his grate to be, that it burnt throughout the day and night without attention; that the quantity of fire might be regulated at pleasure; that the intensity of the fire might be regulated at pleasure; that when set to any desired quantity and intensity it would continue to burn with but slight variation; that it consumed nearly all its smoke; that the fire was always bright and clear, no black coal being seen; that it was very clean when in use, and required no fire-irons; that it gave a large supply of pure warm air; that it burnt anthracite coal, coke, or cinders, or any combination of these; that the chimney-flue did not require sweeping oftener than once in four or five years; that the cost of fuel for it was 1d. for six hours; that no coal-box was required in the room. Mr. Russell continued as follows:—For the accomplishment of these purposes the grate is provided with two flues, one passing upwards in the ordinary way from above the fire, the other commencing below the fire and passing up behind it, the two communicating at any convenient point above the fire. At the junction of these two flues a valve is formed, capable of being regulated so as to divert the draught in either direction. When the valve is open, leaving a free upper draught, the fire is very mild, and in proportion as it is closed the fire increases in intensity, and produces almost a white heat when quite closed. Thus any fire desired may be obtained by simply turning the knob which regulates the valve. Another portion of this invention consists of a vertical tube or chamber for containing the fuel, the lower end of which opens into the back of the grate. It is charged from the upper end, which is then closed air-tight. The fuel, by the action of its own gravity, continues to supply the consumption of the fire. The double flue and valve, as already stated, regulate the intensity of the fire. To regulate the quantity, the front bars are made to draw forward, with a counter-balance weight always tending to draw them back, with a catch to fix them in any desired position. When the catch is removed, the backward pressure stops the fall of fuel, the fire becoming gradually less, and is finally extinguished. By this arrangement a small quantity of fire may be kept burning throughout the night, the bars in the morning being drawn forward and a scuttle of coals supplied, starts it afresh for the next four-and-twenty hours. As the fuel enters at the back, the smoke is evolved from it before reaching the fire, and whether the up or down draught, or both, are in force, it is consumed, the only escape for it being through the fire. The recess in which the grate stands forms a hot-air chamber through which the external air, or where this is not practicable, the air of the room passes.*

Professor Ayrton.—I hope Mr. Dawson will not think me unsound, even if he thinks me unorthodox, if I propose to consider warming quite apart from ventilation. The two things, warming and ventilation, although both in winter performed by our open fireplaces, ought to be as distinct as lighting and ventilation, which again in summer are both left to one agency, the window. We have in England emerged from the state of trusting at night to the fire-light to see by, just as in towns we have abandoned the plan of each man pumping up water from his own well. Let us, then, advance a step further; let us recognise that ventilation, warming, and lighting, are three quite distinct things, to be carried out by three distinct agencies. We are now sufficiently familiar with supplying water as well as artificial light, or gas, from centres: can we not, then, bring ourselves to contemplate the supply of warmth, as well as the supply of ventilation, from centres each quite distinct from the other? That the ventilation of a crowded public building should, as is frequently the case, depend on the whims of people near the windows as to whether they are to be open or shut, is as ridiculous as it would be if people nearest the gas-burners had the right of turning them off, and plunging the rest of the audience into darkness. A continual supply of fresh air in a room which shall be independent of wind, of percolation of air through the walls, as well as of diffusion through open windows, can be effected in one or other of two ways: 1. By propelling the air into the room through proper orifices; 2. By extracting the air. In the first case we have full control of the entering air, since no air will enter the room by open doors or badly fitting windows, or by any other orifices than those provided for this purpose. This is a consideration of some importance, but it is more than balanced by two others, viz., that a fan, when propelling air, seems, according to Burat, to give only three-fifths of the effects that it gives when sucking it out; and again, when air is propelled into a room, the whole supply passes through the propelling arrangement, and there may be a great risk of the freshness of the air being destroyed with such an arrangement. The subject of ventilating by chimney draught seems to be somewhat misunderstood, even by practical men, which is the more unfortunate, as the calculations on the subject are quite simple. The motive power in a chimney simply, of course, depends on the ascensional force possessed by each cubic foot of hot air, and which is equal to the difference between the weight of a cubic foot of hot and cold air. But the effective work got out of such an arrangement is very small compared with the waste of heat necessary to warm the air, and the calculations which Mr. Perry and myself have made, and which will appear in the "Transactions," show this fully. If, for example, the chimney be 50 ft. high, the temperature inside it 300° F., while the outside temperature is 60° F., then the power usefully employed in making 10 cubic feet per second of fresh air enter the room would be only about five-hundredths of a horse power. But merely to heat this 10 cubic feet of cold air introduced into the chimney per second requires about 46 units of heat, which is equivalent to 65 horse power. Hence, to obtain a useful ventilating effect of only five-hundredths of a horse power, we expend as much as 65, or 1,200 times as much as is necessary. But it may be said that the fire is maintained not merely for ventilating purposes, but for warming, or for domestic or for some other purpose, and consequently the chimney draught must be produced, whether we require it for ventilation or not. This argument is, however, quite fallacious, since in an open fireplace very much more air goes up the chimney than is required for combustion, as is seen from the roar that takes place when a blower or a newspaper is held in front of the fireplace. Now in a proper furnace we do not have a quantity of air drawn up the chimney which is not required for combustion, so that unless the amount of air to be drawn for ventilating purposes is not more than the amount of air required for combustion, and unless, also, this air is tolerably fresh and suitable for combustion, there must necessarily be an increased expenditure of fuel to cause a ventilation draught up the chimney; and as we have shown, this expenditure will be made in a most expensive way. And this reasoning is equally correct, whether the air that is drawn into the chimney for ventilating purposes be introduced at the bottom and so warmed by the fire, or whether it be sucked up by a pipe entering the chimney at the top similar to a jet pump. At a penny per horse power per hour, and a steam-engine at between a half-penny and a farthing, a water-meter in London will cost over a shilling per horse-power per hour. Water power is too expensive even for public buildings, dining-rooms, &c., where many people congregate, and separate steam-engines are, of course, out of the question for working fans for ventilation: what are we to fall back on, then, if we wish the ventilation to be independent of windows and fires? We must, of course, use distributed power, and the one which is at our command is gas. Now, judging from the amount of success that has been attained with gas engines of even so small as ⅓ and ¼ horse-power, I do not see the impossibility of a small gas-engine with a fan being employed in every building of any size, to ventilate the rooms summer and winter. Possibly in the future, when electricity is supplied like gas, these may be replaced by small electro-motors, which experiment shows have an efficiency about eight times that of the best steam-engine. Next as to warming, which in Mr. Perry's and my mind is quite a distinct thing from ventilation. In a room heated by an open fireplace, the air directly heated goes up the chimney, and since the greater the heat the greater the draught, we may say that all the heating of the room and its occupants is performed by radiation. When stoves, or hot air, hot water, or steam-pipes are employed, the heat given to the room is partly by radiation and partly by convection, or the circulation through the room of air heated by actual contact with the hot pipes. This heating of the air appears to destroy its

* See p. 224, *ante*.

* We are asked to mention that this grate can be seen in action at Messrs. Archibald Smith & Stevens's, 42, Leicester-square.

freshness, and whether this is due to the destruction of some chemical constituent like ozone, or of aromatic particles such as come from living vegetation, or whether it is merely a drying of the air, or lastly, whether the practical unpleasantness arises from heating without proper ventilation, it is probably preferable to employ simply radiation, and to dispense altogether with the circulation of heated air through the room, if this can be easily and economically done. Now we think this may be effected in one or other of two ways. Either the open fireplaces may be retained in form, but the small radiating surface of incandescent coal replaced by a larger radiating surface of pipes heated by water or steam supplied by a boiler in the building, or, better still, to a whole street or neighbourhood from a common centre; the chimney might remain to carry off the heated air and produce the ventilation of the room, or, better, the ventilation might be performed quite separately, and the chimney-piece furnished with a small ledge projecting downwards to prevent the air heated by direct contact with the hot pipes escaping into the room, so that the pipes should warm the room simply by radiation. Or the present form of fireplace might be abandoned, and the pipes placed vertically in the room, reaching to the ceiling, but not necessarily to the floor, in which case the heated air would cling to the pipes, and not circulate, and this result might be attained with still greater certainty if the vertical pipes were furnished with several small ledges surrounding them, and sloping downwards so as to trap any ascending hot air. It might be objected that our heads will be chiefly warmed by this radiated heat, and that would be unpleasant. But we must not jump to the conclusion that because the radiation of violet rays from the sun on our heads is unpleasant in summer, the radiation of dark heat, such as comes from a kettle of boiling water, or indeed at present from the walls of an ordinary room, would be necessarily unpleasant.

Mr. William White, F.S.A., Fellow, said,—There are considerations which the last speaker has opened up, and which it would be well to take into account. One is the equable or the unequable temperature of the different strata of air in the room. I cannot quite agree with Professor Ayrton that it would be better to warm the ceiling of the room, because that would rather increase the difference of contrast between the temperature at the ceiling and at the floor, and I think there are already many people who suffer as well from hot heads as from cold feet. Some years ago I suffered seriously from the gaslights in my sitting-room, and one evening when the curtain was unhooked, on getting up to the ceiling I was struck with the immense heat into which I was putting my head. On that account I do think these so-called Tobin pipes are of great value, because the natural course of the air is towards the ceiling, tending to make the warmth more equable; and I think the bad air may be carried off without objection by having the exit some feet below the ceiling, say 6 ft. or 7 ft. from the floor. This would prevent the upper stratum mixing much with or vitiating the air below. It would assist in carrying off the unchanged air much better. As regards the warming of the house generally, I have found great comfort from having an air-warmer in or under the hall. The room-doors can then be kept constantly opened, and fresh air being admitted into the hall will create a considerable change of air through the house if there is a proper exit; also for the vitiated air above, as there was in my case.

Mr. E. Spencer Rolfe said that, in the first case, with regard to the ventilation of rooms (speaking more particularly of private rooms, not large halls or churches), one of the simplest fundamental facts was rarely considered. The principle was this. We had the air near the ceiling hot and vitiated; we had the air near the ground less vitiated and certainly very much cooler. Now it was reasonable to suppose that if we introduced fresh air through a tube (like a Tobin tube),—if we introduced cold air through that tube, it should be introduced naturally at some height up the room, in order that it might get partially warm before it reached your face and thereby caused a sensation of cold. But at the same time, in introducing a fresh supply of air into a room, if introduced into the side of the room, it must be more and more vitiated the higher it was introduced, because it would get mixed directly, and more and more vitiated, and fall down, carrying with it its admixture of vitiated air. Therefore, in dealing with ventilation and the introduction of warm air, it should always be observed that warm air, in his opinion, should be introduced as near the floor as possible, and that cold air should only be introduced so high as was necessarry to avoid a draught. How high that might be was entirely dependent on the size and height of the room, and, sad to say, more or less dependent on the occupants of the room. Different people were more or less sensitive, and with regard to Tobin's tubes, there was a very strong objection to them, which was based upon this fact,—that any system of ventilation which we desired to carry out and make thoroughly efficient must in the first place be invisible, or rather not too distinctly perceptible; and the other reason was that it should be placed beyond the control of the occupants of the room. If there was any control, and it was distinctly visible where the air entered, sensitive people, who knew that such a tube as a Tobin tube was intended for the entrance of cold air, would look at it and say in a moment "I feel a draught." The tube was then sure to be closed, and the chances were that it would never be opened again, or very rarely. On a hot day, when the windows were all open and when ventilation was very free, the tube would perhaps be opened too, to allow more fresh air, but at other times it would most probably be closed. With regard to the filtration of air, in all our London houses it was absolutely necessary that we should have some plan for the filtration of air. If that was not tried you would soon find out the inconvenience in the room, and he had found it by practically experiencing it. He would suggest two thicknesses of wire gauze, between which should be placed some "silicate wool," virtually glass wool. It must be put in between the thicknesses carefully, because the slightest obstruction outside the ventilating tube would stop its action. The tube should be made of zinc, or varnished inside, and when you wanted to clean it you would simply pour down a bucket of water. With regard to warming, despite what Professor Ayrton had said, he (the speaker) found it extremely difficult to dissociate warming from ventilation. Our house ventilation was dependent upon heat for the currents, and therefore warming to a certain extent meant ventilation. Professor Ayrton had given a fancy or rather an ideal sketch of a heated ceiling, but he should to a certain extent condemn that. Mr. Rolfe, having referred to the feasibility of warming houses with coils of hot-water pipes, concluded with a reference to open fire-grates possessing a heated air-chamber behind the grate.

Mr. E. C. Robins, F.S.A., Fellow, replying on the whole discussion, said,—Dr. Corfield, who opened the discussion on the 29th of November last, deserves our thanks for his testimony to the general willingness of architects to entertain sanitary questions and to render every assistance in their power to rectify old abuses; and I think I may truly say that architects as a body very highly estimate the labours of the medical profession in this field, of which Dr. Corfield is an eminent example. Dr. Corfield thinks I claimed too high a place for architects when I said that the practice of specialists was in harmony with the previous practice of architects. All I meant to say was that architects had less to undo than was generally supposed; and that, with the growth of public opinion and professional experts, architects also grew and were not behind the best of specialists wherever they gave their minds to it. The inlet and outlet ventilation for house-drains; the better aëration and means of inspection and gaseous disconnexion of house-drains from the sewer by means of man-holes, and other matters, are modern improvements; so also is the admirable system of automatic flushing by means of Field's syphon flushing tanks, which I have used with great success, and fearlessly recommend anywhere and everywhere. In the year 1852–3,—now nearly thirty years ago,—I myself carried out in St. Pancras the various suggestions made by Mr. Chadwick in the blue books of the General Board of Health. And my practice then was to put the syphon trap in the last length of the house-drain next the entry into the sewer,—on the principle that to keep the gases out of the house-drain was better than letting them into it to be trapped within the house or in the area outside the same, as was then and still is the prevailing custom. Moreover, I supposed that, if a stoppage took place, it would be easy for the sewer men to cleanse the trap from the sewer itself. But the sudden fall of house-pipes towards the sewer in the last few lengths was likely to keep the syphon clear. I agree with Dr. Corfield as to the importance of trapping sink-pipes with S traps before passing outwards to discharge over the gully grating. To avoid the freezing up of sink-outlets through the dripping or leaking of taps, plugs may be used instead of gratings to the sink itself. I was glad to find that Mr. Robson, of the London School Board, and author of the valuable work on school building, was able to agree with me in most things. On the old system of supplying water-closets from service-boxes in the cistern, the direct supply of drinking-water therefrom was highly objectionable, especially as the cistern was commonly placed in or over the highest water-closet, but waste-preventers as now used overcome the first evil, and service-boxes are quite discarded. However, just as the fear of bad workmanship makes it desirable to put soil-pipes outside instead of inside the walls, so the chance of defective planning and execution makes it not less desirable to have separate cisterns to supply water-closets only, and, even where constant service exists, an intermediate cistern is desirable. The modern waste-preventer of the water companies provides such a separate service; and if these contain from two to three gallons of water for each discharge, I see no objection to waste preventers, except you choose to employ some water-closet apparatus which will not clean itself without such a scour as no waste-preventing system, short of the noisy "Shrewsbury," will provide. It is this that inclines me to favour trapless closets, the water-seat being above the plug, which, when raised, hurries everything away without the intervention of an invisible trap, which checks the flow, and is rarely quite cleared before the supply of water ceases. I was glad to hear Captain Galton's remarks on ground air, and Mr. Christian's on hollow walls, their advantages and disadvantages. I have elsewhere treated of both. Mr. Symons touched upon a wide subject, viz., the cause of inferior speculative building in the metropolis. Professor Lewis, in his memorandum opening the second discussion, proved too much for his argument, because, as Mr. Rogers Field showed, if his six points were accomplished facts, there would be no special ventilators required. If the storm waters were to be separated from the soil drainage, and a new system of soil drainage were to be constructed on the latest principles of sanitary science and economic construction, it would involve the immediate and complete removal of all organic matter as soon as it was formed; and sewers so constructed, properly flushed and ventilated, would be comparatively innoxious. Nevertheless, as the Professor wisely suggests, chemical means might be employed to neutralise or deodorise the contents of the sewers as a precautionary measure. The memorandum read by Mr. Redgrave, from General Scott, carries out Professor Lewis's idea. Colonel Malone, of Ryde, has sent me a description of his system of doing the same thing in a more complex manner, separately treating each house-drain with liquid precipitants. Mr. George Barnard, a retired Indian medical officer, has fitted up, at his house in Kensington, an apparatus by which the ordinary trapped water-closet may be connected with a removable receptacle for the solid matters, the liquid passing through the perforated bottom, and dripping in to long boxes filled with earth, fixed under one another in zigzag form, five in number. The earth absorbs all the nutritious matters, and the clear water I hold in this bottle is all that comes from the last earth filter, which has no smell. The air from the upper part of the solid excreta receptacle is taken by a pipe into the bottom of a charcoal air-filter, and the pipe that issues from the top brings no smell. The box of solid matter and the supersaturated earth are both valuable articles of agricultural use, and may be sold not only to pay expenses, but to pay a profit. No soil drains and no foul sewers would be required if it were practicable to carry out such a scheme as this, and he thinks it is. Mr. Rogers Field's remarks, as might be expected of him, were all to the point. He was one of the first, if not the first, to employ the new manhole disconnecting arrangement and external well-ventilated soil-pipes. His evidence on the subject of frost is valuable, but it was not given in sufficient detail to be of more than general service. Under all the circumstances, doubtless, it is best to have the soil-pipes external to the building, provided always that the

arms of overflows and wastes are protected from the effects of frost, the pipe being carefully set in cement, in the hole in the wall through which it passes. My experience has shown me that the most frequent defect is in the setting of the apparatus, and leakage is most common at the junction of the pan or syphon with the soil-pipe before it passes through the wall to the exterior. Mr. Rawlinson's vast experience and practical way of looking at everything gives great value to all he says; and the new volume of the Sanitary Institute, detailing the doings and sayings of the Exeter Congress, is full of matter for serious reflection, to which he has contributed largely. I may say that I have used the earth-closet system with great success in country boarding-schools. Professor Kerr's suggestion as to a subway he will soon have the opportunity of seeing realised in the new premises approaching completion in Maddox-street for Mr. Boyd. The iron house-drain and other pipes will pass through a subway, 6 ft. 9 in. in height and 4 ft. wide below the basement. As he justly observes, the engineers are at fault in constructing sewers so as to be in many places elongated cesspools, or sewers of deposit instead of suspension only. It is all very well to complain of our laying on sewer-gas to the houses, but it must not be forgotten that the production of such gases has no business to be. I have elsewhere answered some of the objections made by Mr. Dawson, and have only to repeat what I said in my second lecture at the Parkes Museum with reference to the advantage of vertical shafts for the introduction of fresh air. The Ophthalmic Ward at St. George's Hospital is perfectly ventilated by vertical wall-shafts, as in this room, and there is no other extract shaft than the chimney of the fire, yet there is no perceptible draught in any part of the room.*

WARMING BY RADIATION, WITH COLD AIR FOR BREATHING.

Sir,—As expressed in your article, p. 169, February 5, your curiosity to see how the members of the School Board would be kept warm on a thoroughly cold day, if the *air* is not heated by the coil, strikes the key-note of the whole subject of heating and ventilation.

It is undoubtedly a very important condition of our existence that the temperature of our bodies is many degrees higher than the average temperature of the air with which we are surrounded; the minimum of this difference is about 28°, as the temperature of the blood is 98°, and when the air around us reaches 70° we want it rapidly changed to prevent it becoming heated by the body.

This difference in temperature causes a constant circulation of the air around our bodies, and thus provides a valuable system of natural ventilation. The greater this difference the more rapid and perfect is this natural ventilation. More important still are the effects of the inhalation of cold air.

Although the experiments of physiologists are extremely meagre as to the effect of breathing air at different temperatures, yet it is well understood that when very cold air comes into intimate contact with the hot blood in our lungs the stimulating effect is very great. By some the increased action of the system caused by the diminished temperature of the air inhaled is attributed to the greater amount of oxygen received in the denser air. But this does not account for more than one-fourth of the increased action. Some other cause for the greater stimulation must be given.

Fortunately, we are not wholly dependent on the few experiments of the physiologists for proof of this principle. Every observant person well knows how much more active he is on a clear day, with cool air, and bright sunshine for warmth, than he is when the air is warm, even without the additional heat of the sun.

We have abundant illustrations of this principle of being surrounded with very cold air, yet being comfortably warm. On the sunny sides of streets in cities, when they have a clear atmosphere (I do not mean in London, of course) it is not unusual for the air to be below the freezing-point, and yet a thermometer exposed to the direct rays of the sun would indicate a temperature of 100°. At high altitudes the sun is often inconveniently hot, while the air is very cold. The intense heat of the sun would be unbearable in tropical climates were it not for the cold air immediately above, which is constantly tumbling down to take the place of the air warmed by coming in contact with the hot bodies on the earth's surface.

In every room heated by an open fire the air must necessarily be colder than the temperature indicated by the thermometer, because all the effect of the radiation from the mass of coals (often at a temperature something like 3,000°) must be in excess of the temperature of the air. The air directly in front of the fire is often 20° or 30° below what would be indicated by the thermometer.

It is entirely practicable to stand in a strong current of air,—well, we may say at zero, if you please,—and be abundantly warm either with clothing or without. The firemen charging a gas retort on a cold day, or the firemen in the hold of a steamship, are familiar illustrations. I have frequently gone into the fire-room of a steamer on a cold night, and, standing on the hot plate in front of the furnace and receiving the strong radiant heat from the fires, have allowed a torrent of very cold air to pour down upon my head with perfect comfort and satisfaction.

And yet, notwithstanding these abundant illustrations with which we are constantly surrounded, the proposition to fill an occupied room with very cold air, and at the same time to expect the persons to be comfortably warmed, seems to be a startling one to many thoughtful persons. The principle is a correct one, but the difficulty is in applying it. When you are dealing with two such strong opposing forces it requires skill and good judgment in combining them so as to produce the most satisfactory results.

The open fire, which is the most primitive form of artificial warming, is still persistently clung to, because it gives this valuable principle of direct radiation in its most perfect form, and relieves the room at once of the oppressing and debilitating effect of warm air, because all the air warmed directly by the fire is carried up the chimney.

But the distribution of the warmth is very defective. The heat is applied to the body at the wrong end; the feet are cold and the head hot. The inventions to remedy these defects have been numberless, but none have proved entirely successful. Ever since the days of Franklin, whose careful study produced one of the best air-warming fire-places, every student of the subject of warming and ventilation, upon arriving at a certain stage of his investigations, is certain to re-invent the air-warming fire-place.

At one time I was an enthusiastic advocate of the Franklin fireplace; greater experience and careful investigation, however, chilled my enthusiasm. I found it was killing the goose that laid the golden eggs. The cold air, playing against the fire-box, absorbs so much of the heat that there is not enough left to create perfect combustion, so the fuel is likely to smoulder and pass away in smoke without producing that bright cheerful fire, so charming in a well-constructed fire-place not trammelled with any air-warming contrivance. And, again, the warm air (when heated above the temperature of the room) rises towards the ceiling, and assists in keeping the head warm, but it is difficult to get such warm air to the floor. The difficulty of getting an even and satisfactory distribution of heat is not solved, therefore, by the air-warming fire-place. What is required is some method of warming the solid materials of the floors and lower portions of the exterior walls, or the equivalent of this. The sun shining on the floor very quickly heats it to 100 degs. Many of the solid objects upon which the sun shines brightly are heated above 100 degs., or warmer than the blood.

As a general principle, all solids are warmer than the air surrounding them. This is a great natural law, and must be adhered to in all arrangements for artificial warming and ventilation.

We understand that the Romans heated their marble floors by flues constructed underneath them. Some engineers think there are indications of their having used extensive systems of circulating hot-water under their floors and in the side walls up to the height of the human body.

By skilful arrangement, the modern system of heating by hot water can be made to answer the purpose of warming the floors and side walls very cleverly. But steam possesses some remarkable advantages for distributing the heat which cannot be secured by water. It travels with much greater rapidity, so that it can be utilised quickly in the extreme points of a large building. There are many examples of extensive blocks of buildings being heated by steam at a very low pressure, and where it is carried from 1,000 ft. to 2,000 ft. with very little loss of temperature. Some manufactories, too, and mines, conduct the steam a distance of from one to two miles with perfect success. Steam, therefore, seems to offer to the thoughtful sanitarian and the painstaking and conscientious architect a valuable suggestion, by which possibly they may be enabled to work out a plan for securing an artificial warmth in our inclosed buildings, which can be evenly distributed and retained in the right place, and made to produce much of the excellent effect of sunshine, and at the same time leave the air cool, fresh, and invigorating for breathing.

Lewis W. Leeds.

* A short paper was read by Mr. C. F. Hayward, to which we may refer hereafter.

A CASE OF DRY ROT.

Sir,—As I never remember to have seen any clear description of "dry rot," it may perhaps be considered of sufficient interest to describe a case of this sort, which I have lately met with, with some minuteness. As the external appearances presented by dry rot are very slight in comparison with its fearful ravages where out of sight, it is important that the slightest indication of its presence should be quickly recognised. A painted surface appears never to be attacked until the last, therefore where woodwork is painted the whole internal portions, and even large timbers, may have been destroyed before it is seen externally. The first indication will be transverse cracks appearing upon the surface, every inch or two apart, and at right angles to the grain of the wood. These, after a time, will extend through the paint. Cracks such as these were seen a short time ago in a small portion of the capping and boarding on the inside of the south gallery front, next the east wall, in the church of St. Mary, Somers Town. It had somewhat the appearance of having been burnt, except that it was of a light brown colour instead of being black. It crumbled away at the least touch.

It should be understood that the gallery-front is formed of lath and plaster upon deal stud-work, lined with horizontal deal-boarding within, and finished with a deal capping at top. Upon pulling down some of the boarding the nature and the character of the dry rot was at once seen; and when first brought to light it was a vegetable curiosity. I have seen other cases, but never one so fully developed as this, or so easily examined. It consisted of one enormous plant in the form of a rapidly-growing fungus, with long branches and almost endless ramifications, which adhered closely to the woodwork, and had destroyed its very nature wherever it clung. So much so, that large handfuls of the timbers, measuring 4 in. by 4 in., could with ease be broken away and pulled out. In appearance the plant had a centre stem, which was strong and tough, with a very thin lamina of a light brown colour on each side of it. It had somewhat the appearance of the seaweed called *fucus serratus*, but much thinner and papery. As it ran along it forked to the right and left until it extended and covered the whole surface of the woodwork. In some parts it crossed and recrossed upon itself, and so prolific was its growth that it extended along the timbers, and completely enveloped the whole of the woodwork for a distance of 10 ft. each way from the point where it first appears to have commenced.

This, however, describes the appearance of the plant where it had done its work, and looked to be dead. Upon tracing the stems to their extremities, it could be at once seen that there it was still all alive and growing. These extremities were perfectly white, thick, sticky, and clammy, and were advancing with a rounded edge, like a stream of treacle. It had the well-known smell of all funguses. It was growing in the dark, as all funguses do, between the boarding on one side and the plastering on the other, and the confined air evidently promoted its growth. The laths, timbers, and the inside of the boarding had all perished wherever the plant extended. What could it be feeding upon unless it was the turpentine which existed in the fir?—for it appeared to be confined to that wood. The oak book-board which was attached to the perished capping was untouched and uninjured.

How the plant first germinated is an entire mystery. The church has been built over fifty

years, and the gallery front is of the same date. We know that the capping must have been sound last Christmas twelvemonth, because some of the Christmas decorations were at that time nailed to it. Yet so rapid is its progress, that in the July following 10 ft. at least of the whole front is discovered to be quite rotten. It evidently commenced from the east wall where the timbers of the gallery front entered it, and from this point it also extended, right and left, along two courses of bond timber built into the wall, one at the top and one at the bottom of the gallery front. It also attacked the lintel of the vestry window below. Not only that, but in connexion with the gallery front there is the first column supporting the wooden groined ceiling. This column is formed by four deal shafts, 6 in. diameter each, placed round a central iron core. Of these deal shafts it had destroyed 5 ft. or 6 ft. in height, and if not stopped when it was, it no doubt would soon have communicated itself to the wooden groining above. Curiously enough, there was an open bolt-hole in the central cast-iron column, and the fungus had entered by this hole and had grown inside in the hollow part to such an extent that portions of the plant were pulled out 1 ft. and 18 in. in length.

It is, perhaps, useless to say that the only remedy was to cut out and remove every portion of the woodwork that had been attacked by fungus, and to wash with a solution of nitric acid all the surrounding parts, to endeavour to kill any germs of vegetation which might still be in existence.

As to its cause, I can only venture to offer a suggestion. The point where it commenced is not less than 10 ft. or 12 ft. above the level of the ground, and the wall is about 2 ft. thick (say two bricks and a half), and is apparently perfectly dry. But near the point there passes a flue from the vestry. Is it not possible that the heat from this flue, combined with a slight amount of dampness in the wall, may have generated the plant? And yet how is it that this has not occurred before? The flue has always been in use in the winter time, and if the wall was damp probably it has been in the same state for years past. On the opposite side of the church the gallery is precisely similar, and there is a similar vestry and a flue from the fire-place, but this is never in use. Here not the slightest trace of the fungus is to be found, and the woodwork is as sound as when first put up. It cannot have arisen from any seed or spawn contained in the timber, or it would have been propagated years before. It, therefore, must have been generated by some peculiar state of the materials,—something communicated from the bricks to the woodwork. Probably if the woodwork had been open to the air and properly ventilated it could not have arisen. Perhaps some of your correspondents may be able to throw some further light upon the matter.

JAMES K. COLLING.

BUILDERS' CLERKS' BENEVOLENT INSTITUTION.

THE annual general meeting of this institution was held on Tuesday evening, at the offices, 27, Farringdon-street, under the presidency of Mr. Stanley G. Bird, who was supported by a large number of friends of the Institution, amongst whom were Mr. S. T. Holland, Mr. H. Colls, Mr. T. Stirling, Mr. W. Heath, Mr. H. T. Bayes, Mr. E. Graystone, Mr. E. Brooks, Mr. J. Robson, Mr. E. C. Roe, and Mr. H. J. Wheatley (secretary).

In the annual report the committee congratulate the donors and subscribers on the increase in the annual revenue, observing that while some societies still suffer by the general depression in trade, the balance-sheet of the Builders' Clerks' Institution shows an increase of 139*l.* 12s. 11d. beyond that for the preceding year. The total number of pensioners at the present time on the relief is ten, and there are two children being maintained and educated in connexion with the orphan fund. During the year temporary relief has also been afforded. A further investment has been made of 300*l.* of which sum 100*l.* was placed to the relief fund, and 200*l.* to the orphan fund. In closing the report, the committee say that there is good cause to be satisfied with the progress made since the institution was founded in 1866, and express the hope the same support will be continued in the future.

The financial statement showed the subscriptions to be 186*l.* 7s. 6d.; donations, 163*l.* 16s. on the relief fund. The income of the orphan fund was 741*l.* 14s. 2d. The total income of the institution was 2,061*l.* 5s.

The Chairman, in moving the adoption of the report and balance-sheet, stated that much credit was due to the secretary and committee for the economical manner in which the business had been conducted. He might, however, be permitted to state that with their present machinery much more might be done, and it must be their careful study to enlarge the society as much as possible.

Mr. Brooks seconded the motion, and the report and balance-sheet were adopted. A vote of thanks was presented to Mr. S. T. Holland, the retiring president, and Mr. Holland replied. The committee were re-appointed, and thanks were tendered for their past services.

CITY STATIONS.

SIR,—What you remark with reference to the extravagant scheme of the London, Chatham, and Dover Company for providing additional accommodation in the City is perfectly just; and perhaps it may not even now be too late to persuade the Company, as much for their own interests as those of the public, to try first what can be done with their old stations.

If the Holborn-viaduct Terminus were extended in the direction of Ludgate-hill, with an entrance from that street, there would then be no necessity for main-line and Crystal Palace trains to stop between it and Blackfriars, and the space now taken up by the present east platform could be utilised for the through traffic. Then by extending the station over the carriage-yard, as in the new extension to Waterloo, an additional width would be gained sufficient for a wide platform and waiting-rooms, and, if necessary, an additional pair of tracks.

Nothing could be more annoying and uncalled for than for trains to stop three times between Holborn and the river; and the alternative of certain trains only running to Thames-street, and necessitating a change for passengers going on, would be even worse.

How much better it would be if the company, instead of thus wasting an enormous sum of money in making a new station, and a bridge, which, if the plan suggested in this letter were adopted, would be unnecessary, would come to terms with the South-Eastern for making sidings where one line crosses the other, and running through-trains from South London to Cannon-street and Charing-cross, or even of removing the now almost useless Borough-road Station to the crossing, so that South Londoners could get by rail to Charing-cross, Westminster, and, above all, the City proper, by rail, instead of having at present no conveyance but omnibus. When we consider how much nearer the chief business centre Cannon-street is than Ludgate-hill, it is evident what a profitable undertaking this would be for both companies.

One can only suppose that some great authority with the company has a special interest in promoting such costly follies as they have committed from the first, as in building two stations in Southwark where one, at the South-Eastern crossing, would have been so much more convenient and valuable; then in making three in the City at a spot where one large one would have sufficed; and now, by adding still a fourth, and a bridge, which must be useless, since no more trains can pass over it than over the rest of the line to the south.

EVACUSTES.

Appeal against Award.—At the Wolverhampton Town Hall, the acting Under-Sheriff for the county held a special sitting with a county jury to decide on an appeal by the Corporation against the award of Sir Henry Hunt, C.B., the official arbitrator under the Wolverhampton Artisans' Dwellings and Streets Improvement Scheme, in respect of the value of certain property situate in the condemned area affected by the scheme. The property in question is the Greyhound Inn, Little Berry-street, owned by Mr. William Dulson; and the Corporation were the nominal appellants, although both they and Mr. Dulson were equally dissatisfied with the award of the arbitrator. After hearing evidence on both sides the jury awarded claimant 2,100*l.*, which was a reduction of 460*l.* off the amount awarded by Sir Henry Hunt.

"PERSIAN PLAN-DRAWING."

SIR,—Your correspondent, "Meter," has attributed to my short letter on the above subject conclusions which were neither expressed nor intended, and found fault with me for opinions which he has invented for me.

My suggestion was merely an application of the very simple axiom that similar effects are often the result of similar causes; and the only reply I need make is to request that any reader who may have been led to notice "Meter's" letter will be kind enough to refer to my original letter in your impression of the 12th, and to credit me with merely the simple and obvious meaning of my words, and not with the much more extensive meaning which "Meter" has evolved out of them.

H. H. STATHAM.

THE DRAINAGE OF MINING TOWNS.

SIR,—For a long time past I have carefully read all reports of discussions and all articles bearing on the subject of sanitary engineering, in the hope of seeing some reference to the drainage of towns in mining districts, but in all cases it seems to be tacitly assumed that the area to be treated either is or ought to be immovable. So far is this from being the case that in some places a subsidence of 2 ft. has been known to take place in twelve months, and there are examples in the salt districts where streets which were recently level now show a depression of 10 ft. or 12 ft. Where sewers have been laid in such situations the subsidence of the ground will gradually draw the sockets of the pipes, or, if brickwork is used, the culvert must inevitably collapse, and, as a consequence, the lowest point will become the centre of a great underground cesspool, from whence the sewage will gradually impregnate the ground on all sides.

To show how little this is regarded by engineers I may mention the case of a salt town which has recently had a costly system of sewerage laid. The system adopted was the conventional one used in towns where no danger is to be apprehended, and, as if to exaggerate the evil, it was made compulsory to provide every house with a water-closet draining into the public sewer. It happens in this instance that the sinking is chiefly in the most densely-populated part of the town, and, in a few years, the excreta, which might have been utilised in the surrounding agricultural district, will begin to accumulate under the streets, gradually spreading beneath the houses themselves. The consequence to the health of the inhabitants may be easily surmised. The question of treating such places seems of great importance, and you would be doing a service in bringing the subject prominently forward. If nothing else were accomplished, engineers would be placed on their guard when preparing schemes for such towns on future occasions.

J. NEAVE.

BOILER EXPLOSIONS.

SIR,—Your correspondent "P. J. Davies," is evidently a practical man, and his letters are consequently to the point, but has he not demolished his own case? If the expansion-pipe of the cylinder system is *liable to be frozen like all other pipes when exposed*, it is evident that it is in no worse position than the pipes of his favourite double system. But he will, no doubt, remember that I laid particular stress on the vital importance of protecting all flow, return, and expansion pipes from frost, and further recommended the increased security of a safety-valve. But P. J. Davies says that safety-valves are not to be depended on. I am afraid that this is a very uncomfortable conclusion to arrive at, in the interests of large classes of the community; but I should say it is the same with safety-valves as with all other mundane matters, the absolutely perfect is unattainable. Although there are plenty of them that are as near perfection as may be, and reliable under all ordinary circumstances, the "Yankee" system would not now be in general use in Glasgow, Liverpool, Manchester, and throughout the United States of America, where we must presume that people know something of these matters, were it found to be generally dangerous. The fact is, there must always be a certain amount of danger where a hot-water system exists, unless moderate care and supervision be exercised. Let Paterfamilias "take advice," as suggested by some one in rhyme in your columns a few numbers back, and consult the practical man who supplies him as to the nature and working of the apparatus provided for the supply of hot and cold water, and see that his servants understand the risks that they run by neglecting his instructions, and we shall have fewer explosions. I am sorry to say that I remain unconvinced by Mr. Davies's arguments, and am still, on the contrary, persuaded that less danger exists in the cylinder system, with safety-valve and expansion-pipe, than in the double-pipe system with hot-water tank in any position, while at the same time you have the advantage of being able to withdraw the hot-water from the entire system without an admixture of cold.

JOHN SMEATON.

COMPETITIONS.

School and Chapel Selby.—The Premiums in this competition have been awarded as follows:—

1st Premium.—Messrs. Wm. Waddington & Son, of Manchester and Burnley. Motto, "Experientia."

2nd Premium.—Mr. C. O. Ellison, of Liverpool. Motto, "Liverpool."

3rd Premium.—Mr. E. Birchall, of Leeds. Motto, "Raikes."

The contemplated outlay is about 4,000*l.*, and the work includes alterations and additions to the Wesleyan Chapel, and the erection of new Day and Sunday Schools in connexion therewith.

Cemetery Chapels, West Derby (Liverpool).—Some of the competitors complain of the announcement by the Committee that they are taking steps to ascertain whether the three designs selected by them can be carried out for the sum specified, and urge that the authors themselves of these designs should have been called on each to substantiate the correctness of his estimate by submitting a *bonâ-fide* tender from a respectable contractor. We are very much disposed to think that if this course had been adopted by the Committee, there would have been an outcry against the costly trouble thereby given to the authors of the three selected designs.

SNOW THAWING BY STEAM.

IT is highly desirable that the snow should be removed from the roads and pathways of a town as speedily as possible, and be permanently got rid of. As a test for thawing, carried out at Messrs. Merryweather & Sons' fire-engine works, a cart-load was melted away into the sewer in seven minutes, the steam-boiler of a steam fire-engine being fitted with a superheater (at a cost of 30s.) for the purpose. The surveyor of St. George's, Hanover-square, Mr. Livingstone, had one of these superheaters fitted to the steam roller, and when so arranged, the machine quickly disposed of a large quantity of snow, until then standing in Belgrave-square.

CASE UNDER METROPOLITAN BUILDING ACT.

SHOP FRONTS.

MR. BEDFORD, the builder of an extensive block of houses, attended before Mr. Paget, on the 11th inst., at the Hammersmith Police-court, in answer to a summons taken out by Mr. T. E. Knightley, district surveyor for Hammersmith, to show cause why he should not separate eight shop-fronts, fascias, and cornices, with fireproof pilasters and trusses, and limit projection of shop-fronts to 5 in. from external walls (section 26, rules 2, 3, and 5).

Mr. Knightley conducted his own case. Mr. J. Haynes, solicitor, appeared for the defendant.

The District Surveyor stated that, as at present constructed, the pilasters between the shops were of wood, and that the fascias and cornices (also of wood) were continuous from one end of the building to the other, calling his assistant to prove this, and also that the shop-fronts projected considerably more than is permitted by the Act.

Mr. Haynes called witnesses, one of whom admitted that the pilasters had been as described, but that an alteration had been commenced; whereupon the magistrate allowed Mr. Knightley his costs for the day, adjourning the summons for the requirements of the Act to be carried out; after which the parties met on the works, and defendant undertook to make application to the Metropolitan Board of Works for "special sanction."

Books.

The Rudiments of Civil Engineering. By HENRY LAW, M.I.C.E. Including a Treatise on Hydraulic Engineering, by GEORGE R. BURNELL, M.I.C.E. Sixth edition, revised with large additions on Recent Practice in Civil Engineering, by D. KINNEAR CLARK, M.I.C.E. London: Crosby Lockwood, & Co., Stationers' Hall-court, Ludgate-hill. 1881.

THE original version of this book, now thirty years old, was well thought of, as it deserved to be, and passed through several editions. Mr. Kinnear Clark, by omitting portions rendered obsolete by the advanced practice of construction, and substituting many new chapters on modern practice, has produced an admirable volume which we warmly recommend, as well to architectural students as to young engineers.

VARIORUM.

"STUDIES in English Architecture," by J. Langham, is the title of a thin quarto book of very excellent drawings, very well lithographed. Having no title-page, nor even the name of the publisher, it seemed useless to mention it, and it has been on our table for many months. Quite accidentally we have just now learnt that the author's address is 28, Friar-lane, Leicester, and we willingly print it because of the merit of the work.——"God's Acre Beautiful; or, The Cemeteries of the Future," by W. Robinson, F.L.S. (Office of the *Garden*, Southampton-street), is a daintily-printed and illustrated little book, the tendency of which is to promote the practice of cremation. We fully agree with the author in saying that the whole question of the interment of the dead will have to be seriously considered before long. "Cemeteries are becoming not only a difficulty, an expense, and an inconvenience, but an actual danger."——"The Capitals in the Crypt of Canterbury Cathedral" are described and illustrated by J. Donkin, architect, in a *brochure* published by W. J. Johnson, 121, Fleet-street. The crypt when we last saw it seemed much in want of attention, and the author of these rather tame but, still, useful sketches, says it is so now.—— We have before now recommended "Spon's Architects, Builders, and Contractors' Pocket-Book of Prices and Memoranda," edited by Mr. W. Young. The issue for 1881 includes further additions.——Bevis's "Builders' Price Book" and "Guide for Estimates" has been published for 1881. It has been revised and added to.——The little volume of "Measures, Weights, and Moneys of all Nations," by W. S. B. Woolhouse, F.R.A.S., supplied a want, and we are not surprised to find a sixth edition just now issued, by Crosby Lockwood & Co. It contains much useful information, and is doubtless very correct. Unfortunately, however, the one term we looked for under the head of Spanish money, *peseta*, we could not find.——Part 2, Vol. IV., of "Transactions of the Bristol and Gloucestershire Archæological Society," includes an interesting illustrated paper on "Earthworks in the Parish of English Bicknor," by Sir John Maclean, F.S.A.——In a pamphlet, entitled "Electric Meteorology" (Slatter & Rose, Oxford), Mr. G. A. Rowell, of the Ashmolean Society, again puts forward his theory as to the general agency of electricity in the cause of rain, and its allied phenomena, and asks for full consideration of it. He supposes that the molecules of watery vapour are completely enveloped in a coating of electricity, to which they owe their buoyancy. This coating and buoyancy he supposes to increase and decrease in ratio with the temperature of these molecules. Efficient conductors, therefore, of electricity will suffice, on this theory, to precipitate watery vapour either as rain, or snow, or mist. We have always had a strong belief in the general correctness of the theory, and we can sympathise with the author in the expression of his anxiety to obtain a full consideration of it from scientific men, in the hope that he may have the satisfaction of knowing that the study of his life has not been altogether in vain, and that he has added his mite to the general stock of human knowledge.

Miscellanea.

Lincoln Master Builders' Association.—The annual dinner of the members of the Lincoln branch of the National Union of Master Builders took place last week. The President of the Association, Mr. W. Kirk, occupied the chair, and Mr. H. S. Close (vice-president) the vice-chair. The usual loyal toasts were given from the chair and duly honoured. "The Health of the President," proposed by the Vice-President; of "The Vice-President," proposed by the President; and of "The Secretary," proposed by Mr. Geo. Morgan, followed, were received with the usual honours, and duly acknowledged. The vice-president and secretary each alluded to the new Employers and Workmen Act, and its probable effect upon the building trades. The Association was anxious that workmen should have the full benefit of the Act, and, therefore, proposed to form an insurance fund to meet any contingencies which might arise. Representatives of several trades, more or less connected with building operations, were present at the dinner, and it was suggested that the employers of labour in these trades should join the Master Builders' Association, and thereby reap the advantages of that association, and also of the insurance fund. Several gentlemen said they were anxious to join, and Mr. Sims (secretary) promised that when the insurance tables came to hand he would call a meeting for the purpose. The step, Mr. Sims said, was quite in accordance with the views of the General Council of the Master Builders of Great Britain, and already a large contingent of Scotch plumbers, painters, &c., had joined.

Fatal Fall of a Chimney-Stack.—On Saturday last Mr. G. H. Hull resumed an inquiry at the Greyhound Hotel, Sutton, as to the death of Mr. Richard Watson Bradford, aged forty-eight, secretary of the Bank of British North America, of Benhill Wood-road, Sutton, who met his death from the fall of a stack of chimneys on his house during the severe gale of the 8th inst. Mr. Ralph Nevill, architect, was called as a witness. He is reported to have said that, in accordance with instructions from the Home Office, he had inspected the spot. The chimney which fell was 11 ft. high, which was too great an altitude for safety. The mortar was fairly good, but there was not sufficient lime to give it cohesion. Mr. Henry Potter said that in 1878 he was in partnership as a builder with Mr. Ferridge, of Sutton. The stack of chimneys was erected by them. The workmanship was good, and the quality of the materials the best. By the Coroner: There was no special architect employed. The house was built from "a copy." It was erected by piecework. Mr. William Richardson, formerly a surveyor, but now an inspector of nuisances, said he had examined the plans, and he was of opinion that the chimney was properly constructed, and the cause of its falling was the unusual force of the cyclone. After an inquiry lasting nearly three hours the jury returned a verdict of "Accidental death," adding that they were of opinion that more care should have been used in the design and construction of the chimney. The *locus in quo* is apparently beyond the jurisdiction of the Metropolitan Building Act, but were the local Building By-Laws observed in this instance?

A New Method of Inlaying Wood.—A new method of inlaying wood has been contrived by a furniture-manufacturing house, the process of which is as follows:—A veneer of the same wood as that of which the design to be inlaid consists—say sycamore,—is glued entirely over the surface of any hard wood, such as American walnut, and allowed to dry thoroughly. The design is then cut out of a zinc plate, about one-twentieth of an inch in thickness, and placed upon the veneer. The whole is now subjected to the action of steam, and made to travel between two powerful cast-iron rollers of 8 in. in diameter, 2 ft. long, two above and two below, which may be brought within any distance of each other by screws. The enormous pressure to which the zinc plate is subjected forces it completely into the veneer, and the veneer into the solid wood beneath it, while the zinc curls up out of the matrix it has thus formed, and comes away easily. All that now remains to be done is to plane down the veneer left untouched by the zinc, until a thin shaving is taken off the portion forced into the walnut, when, the surface being perfectly smooth, the operation will be completed. It might be supposed that the result of this forcible compression of the two woods would leave a ragged edge, but this is not the case, the joint being so singularly perfect as to be inappreciable to the touch: indeed, the inlaid wood fits more accurately than by the process of fitting, matching, and filling up with glue, as is practised in the ordinary mode of inlaying.—*Timber Trades Journal.*

Institution of Surveyors.—At the meeting held on the 7th of February, a discussion took place on the paper on "Rural Water Supply," &c., read by Mr. Lucas at the previous meeting. The following candidates were balloted for, and duly elected, viz.:—As members, Thomas Bannister, Hayward's Heath, Sussex; and John Camden Mortimer, Westminster. As Associates: Evan Nevile Crofts, Lincoln's Inn-fields: Harry Garrard Few, Lancaster Place, Strand; Herbert Ingleby, Ilford, Essex; and Tonman Mosley, King's Bench Walk, Temple. At the meeting held on Monday last, a paper was read by Mr. G. R. Crickmay (Member), on "Ecclesiastical Dilapidations."

Value of Freehold Property at Queen Anne's-gate.—A freehold mansion, situated at Queen Anne's-gate, belonging to the Burdett family, was offered for sale at the Auction Mart last week by Messrs. Norton, Trist, & Watney. The building contains five lofty floors and a basement. The particulars stated that a piece of garden ground attached to the mansion, opening to Birdcage-walk, was held from the Crown at a ground-rent of 6*l.* 10*s.* 6*d.* per annum. It was announced that the property was offered by order of the co-heiress of the late Sir Robert Burdett. There was much competition for the property, which was sold for 7,150*l.*

British Archæological Association.—At the sixth meeting of the present session, Mr. Thos. Morgan, F.S.A., in the chair, Mr. Loftus Brock, F.S.A., described the progress of the discoveries at Leadenhall-market. Large masses of Roman walls continue to be exhumed, and these prove to be the foundations of a building of large size, probably of basilican form, which appears to have had an eastern apse, with two transept-like chambers to the south, with other buildings to the west. Traces of four distinct burnings have been found. The first paper was by Mr. Francis Brent, and descriptive of an internment found at Castle-street, Plymouth, and which proves to be of Romano-British date. The discovery was made in the heart of the present town in preparing the foundation for an iron column of a warehouse. The second paper was by Mr. Chas. Watkins, who described in detail the portion of the old city rampart of London recently discovered at Houndsditch and removed. About 70 ft. of the wall were cut through, and the lecturer minutely described the construction. The wall was of Kentish ragstone, bonded together with the usual bright red tiles, and having a chamfered plinth on the outer side. A discussion ensued, in which the work was pronounced to be of Roman date, and it corresponds very closely to the portions of the wall recently found in the Tower and in America-square. The third paper was by Mr. J. Romilly Allen, F.S.A. Scot., and was on the pre-historic structures at Tealing, Forfarshire. There is a perfect underground house and many stones with cup and ring markings.

Gas for Cooking.—Mr. A. Percy Smith, of the Temple Observatory, Rugby, has for eight consecutive days measured the quantity of gas consumed in his house for cooking and for lighting purposes. His measurements show conclusively that little addition is made to the gas bill of an average household by its use for cooking. In this case the gas used was the ordinary town's supply, at 3s. 5d. per 1,000, and the apparatus consisted of the oven and boilers made by Mr. Thomas Fletcher, of Warrington. The result showed that while, for illumination, 860 cubic feet of gas had been used, costing 2s. 11½d., the preparation of food had required only 200 ft., costing 8d. The daily average was, for lighting, 4½d. per day; for cooking, 1d. per day. An average kitchen fire of the ordinary open pattern will consume coal to the value of about 2s. per week, and of the fuel used 10 lb. to 20 lb. will go up the chimney as smoke and dust. It must be borne in mind, however, that the actual work done by the Fletcher burner, as compared with the ordinary Bunsen, has been tested by Mr. R. Brigge, C.E., and found to be as 450 to 244, and thus the cost of a cooking apparatus fitted with the usual burners would be nearly double that of the experiment referred to. It is evident that the substitution of gas for coal in cookery is a distinct economy, and its universal adoption would also prevent tens of thousands of tons of coal being annually wasted in polluting the atmosphere of our towns.—*Design and Work.*

Tin-lined Lead Piping.—Mr. Harold Ansdell, whose name ought to help him in some quarters, is seeking to revive the use of tin-lined lead piping, and tin-lined sheet lead, as preventives of lead-poisoning through water. That injury has been, and is being, done through the contamination of water with lead is quite certain, and the present arrangement, which has now been before the public some years, seems well calculated to prevent the evils complained of. In pliability it does not differ in any appreciable extent from lead pipe, as it is easily bent to any desired form or angle, without in the slightest degree affecting the interior tin pipe, which comports itself physically as a part of the body of the lead pipe, but yet remains distinct in its metallic and chemical properties. The manufacturers are Messrs. Quick, Barton, & Co., of Rotherhithe. We understand that the piping is being used very extensively on the Continent. The cost is not materially greater than that of the ordinary pipe, because the strength of the lining allows of a somewhat less thickness of pipe as a whole.

Tunnel Excavators' Disease.—The *New Zurich Zeitung* says that Dr. Giacconi, a physician in Airolo, has discovered that the sickness from which workmen engaged in excavating tunnels, &c., suffer so frequently is due to peculiar parasites (*Aukylostomi*) which make their way into the bowels of persons employed under the earth.

Landlord and Tenant.—At Greenwich County Court was tried the jury case of "Currey *v.* Linders," being an action to recover 50*l.*,—40*l.* for rent paid in advance, and 10*l.* the expenses of removal, consequent upon the dampness of a house. The plaintiff alleged he was induced to take a house in the Brockley-road, New-cross, on a three years' agreement, at 40*l.* per annum, paying the first year's rent in advance, on the representation of the defendant that the house was dry and healthy. After he had been in the house a few days he had occasion to go to Paris, and on his return was surprised to find water in the cellar, and the paper on the drawing-room walls peeling off through the damp. He suffered much from rheumatism whilst in the house, and was compelled to leave it. The defendant admitted that the house was damp, and denied that he ever told the plaintiff it was dry; in fact, he was not asked whether it was dry or damp. The judge, Mr. J. Pitt Taylor, told the jury the law of England did not compel a landlord to say whether a house was fit for habitation, but in the present case they had to consider whether the defendant had fraudulently represented the house to be dry when he knew it was damp, for the purpose of letting it, and whether it was fit for habitation by a family man. The jury returned a verdict for the plaintiff for 50*l.* and costs.

Overhead Telegraph Wires.—Concurrently with the publication of the article on this subject in our last week's number, the *Manchester Courier* contained the following paragraph:—"The continually increasing number of telegraph wires that are carried across the streets and buildings of this city, both for the postal service and the use of manufactories, warehouses, and public institutions, and the inconvenience and danger likely to arise therefrom, is a matter that has for some time been engaging the attention of the Corporation. Representations have been made to the Postmaster-General suggesting the desirability of all the Government wires being conveyed under ground, and we understand that Mr. Fawcett has intimated in reply that already this has been done to a considerable extent, and that the department intends gradually to deal with those which now cross the thoroughfares in a similar manner. We believe it is the intention of the Corporation to require the telegraph companies, and the owners of all private wires, to place these means of communication under ground."

Eastbourne Exhibition of Sanitary Appliances.—A committee has been formed, and the exhibition will be held in the Pavilion, commencing on the 22nd of August, 1881, and continue to the 27th inclusive. The object, of course, is to advance sanitary science and building construction, and to popularise recent scientific improvements. The judges (appointed by the council) will award certificates of merit for any articles they may consider deserving of praise. Dr. Jeffery is president; Mr. Schmidt, treasurer; and Mr. J. Rodda, secretary.

The Founders' Company.—The members of the court of this company have awarded their freedom and livery, with a prize of 10*l.* 10*s.*, the gift of Mr. Robert Warner, to Mr. Hugh Stannus, architect, for his essay on "The History and Art of Founding in Brass, Copper, and Bronze." The second prize of 5*l.* 5*s.*, for essays on "The Art of Founding," has been awarded to Mr. Edward Tuck, of the Chantry Works, Sheffield. This prize was the gift of Mr. H. D. Poole, a liveryman of the company.

A Terrible Disaster at Munich.—On the evening of the 18th inst. a terrible accident occurred at Munich. The students at the Academy of Painters were holding a masked *fête*, when the costumes of some of those present caught fire. Four of the young artists were burned to death, and four others have since died from the injuries sustained, making a total of eight deaths.

National Association for the Promotion of Social Science.—At a meeting of the Association to be held on Tuesday, the 1st of March, a paper by Mr. John Frederic Bateman, F.R.S., entitled, "Observations on the Proposed Measures for the Prevention of Floods," is to be read and discussed.

Mr. J. B. Prior, joint-secretary of the Amalgamated Carpenters' and Joiners' Association, Manchester, has been nominated by the Home Secretary to the factory inspectorship which was offered a short time ago to Mr. Broadhurst, M.P. (who declined the appointment).

Andover Archæological Society.—At a meeting of this Society, held at the Town-hall, Andover, on the 19th, a paper was read by Mr. Drinkwater Butt on "Mediæval Architecture." A discussion followed, in which the Rev. C. Collier (President), the Rev. H. C. M. Barton, and other gentlemen took part. The paper was illustrated with a number of drawings by the author.

A Church Burned.—The parish church at Northaw, Herts, was destroyed by fire on Sunday last. Flames burst through the floor from the heating apparatus about nine a.m. About two years ago the church, which is of great age, was entirely restored within, and a new organ had been erected, opened only a month or two ago.

Testimonial.—On Friday last, the 18th inst., a meeting was held in the Drill-hall, Rotherhithe, on the occasion of the presentation of a testimonial to Mr. S. Brownfield, the Superintendent of the Surrey Commercial Docks, by the *employés* of that large company. The testimonial consisted of a silver tea and coffee service and salver, and there was the large number of 861 subscribers.

The Old Churchyard, King's-road, Chelsea.—The Chelsea local authorities have obtained the necessary faculty from the Consistory Court, and in accordance with the powers with which they are now armed the gravestones will shortly be removed, and the churchyard improved and laid out ornamentally for recreative purposes.

TENDERS

For eight houses for the Trustees of the Whitechapel Charity Estates. Mr. W. A. Longmore, architect:—

Hunt	£4,176 0 0
Read	4,153 0 0
Pritchard	3,997 0 0
Little	3,789 0 0
Sparks	3,700 0 0
Hearle	3,683 0 0
Ashby Bros	3,673 0 0
Outhwaite	3,587 0 0
Gilbey (accepted)	2,594 0 0

For alterations to six houses in York-road, Battersea. Messrs. Muggeridge & Powell, architects:—

Burman	£645 0 0
Canning & Mullins	604 0 0
Whitby	550 0 0
G. & S. Fisher (accepted)	532 0 0

For the erection of dye-works, &c., Notting-hill. Mr. Chas. F. Jones, architect. Quantities by Mr. E. Power:—

Ashby, Bros.	£1,297 0 0
Uff	1,230 0 0
List	1,195 0 0
Stainer & Son	1,168 0 0
Little	1,158 0 0
Deards	1,158 0 0
Colley	1,141 0 0
Grover	1,078 0 0

For alterations at the "Whyttington Stone," Highgate-hill, for Mr. Law. Mr. William Smith, architect:—

Mattock Bros. (accepted)	£417 0 0

For Mission Church and Sunday school, Milkwood Estate, Herne-hill. Messrs. Harnor & Waters, architects:—

	Main Building.	Apse.
Wagner	£2,260	£300
Sawyer	2,030	255
Taylor	1,947	275
Downs	1,903	193
Hooper	1,895	215
Pack Bros.	1,797	239
Tyerman	1,766	185
Parker	1,749	193
Beale	1,637	247

For the erection of the new Church of St. Chad, at Mill-hill, Derby. Mr. H. G. Turner, architect. Quantities by Mr. R. Waite:—

Collins, Tewkesbury	£5,900 0 0
Hair, Church Gresley	5,561 10 0
Thompson, Derby	5,410 0 0
Walkerdine, Derby	5,325 0 0
Webbe, Buxton	5,077 0 0
Walker & Slater, Derby	4,990 0 0
Allen, Leicester	4,949 0 0
Bramage, Leek	4,947 0 0
Hewitt, Derby (accepted)	4,700 0 0

For the erection of Presbyterian Church, institute, shops, and dwellings, Somers-town. Mr. George Lethbridge, architect:—

Church.	
Higgs & Hill	£6,673 0 0
Dove Bros.	6,545 0 0
Brass	6,346 0 0
Williams & Sons	6,137 0 0
Harris & Wardrop	6,100 0 0
Institute.	
Dove Bros.	1,449 0 0
Brass	1,434 0 0
Higgs & Hill	1,393 0 0
Williams & Sons	1,303 0 0
Harris & Wardrop	1,300 0 0
Dwellings.	
Dove Bros.	4,100 0 0
Higgs & Hill	3,968 0 0
Brass	3,788 0 0
Williams & Sons	3,740 0 0
Harris & Wardrop	3,394 0 0

For erecting chapel, laying-out, draining, and enclosing ground, for the Great Ilford Burial Board, Ilford, Essex. Mr. C. J. Dawson, architect:—

	Laying out and draining.	Enclosing ground.	Chapel.
Coker, Luton	£401 4	£741 0	£1,280 14
Drake, Ilford	—	525 0	785 0
Mills, Ilford	327 0	*498 0	*708 0
Smith, Barking	325 0	—	—
Holloway, East Ham	298 0	—	—
Wood, Chelmsford	288 0	493 0	727 0
Thorogood, Romford	280 15	529 5	681 11
Impey, Leytonstone	*272 19	—	—
Wood, Leytonstone	268 0	519 0	695 0

* Accepted.

For new Wesleyan Chapel, schools, &c., Munster-park, Fulham-road. Mr. James Weir, architect:—
Gibbs & Flew (accepted) £5,580 0 0

For new oak shop-fittings, counters, &c., at 121, Oxford-street, for Mr. J. H. Hill. Mr. Wm. Goldsmith, architect:—

Treble & Co.	£674 0 0
Sage	510 0 0
Drew & Cadman	439 0 0
Lascelles	423 0 0
Berridge & Traise (accepted)	375 0 0

For new school-room and alterations to Nos. 49 and 51, Tollington-park, for Mr. R. Wills. Mr. F. H. Stringer, architect. Quantities by the architect:—

Harold	£1,334 0 0
Bristow	1,241 1 6
Pocock	1,260 0 0
Hewett	1,153 0 0

Accepted for the erection of co-operative stores, School-lane, Walton-le-Dale, Preston. Messrs. Longworth & Gardner, architects:—
Myerscough & Marlow (Brickwork, &c.).
Sparling (Masonry).
Nickson (Slating and Flagging).
Jones (Plastering).
Corbishley (Plumbing, Glazing, and Painting).
Hill (Carpentry and Joinery).
Dryden (Ironwork).

For alterations and shop-front, King-street, Great Yarmouth, for Mr. G. Bristow. Mr. J. W. Cockrill, architect:—

Carpenter and Joiner's Work.

Cooper, Great Yarmouth	£249 10 0
Salmon, Great Yarmouth	237 10 0
Springall, Great Yarmouth	229 0 0
Bray, Great Yarmouth	211 0 0
Norfor, Great Yarmouth	210 0 0
Want, Great Yarmouth (accepted)	205 0 0

Painting, Plumbing, and Glazing.

Woolverton & Son, Great Yarmouth	119 6 0
Rainer, Great Yarmouth	112 16 0
Norman & Son, Grest Yarmouth	105 10 0
Green, Southtown	105 0 0
Goffin, Great Yarmouth (accepted)	93 17 0

For Master's house, for the Stokesby and Herringby U.D. School Board, Stokesby, Norfolk. J. W. Cockrill, architect:—

Beach, Yarmouth	£382 0 0
Kemp, Gorleston	379 0 0
Bray, Yarmouth	377 0 0
Balls, Yarmouth	366 0 0
Poxon, Yarmouth	354 0 0
Withers, Yarmouth	339 0 0
Springall, Yarmouth	335 0 0
Want, Yarmouth	327 0 0
Rand & Cooper	320 0 0
Brand, Stokesby	316 0 0
Salmon, Yarmouth	304 0 0
Newman, Yarmouth	297 0 0
Harbord, Yarmouth (accepted)	294 0 0

For two cottages and farm buildings, Filby and Ormesby, Norfolk, for Rev. Charles Lucas. Mr. J. W. Cockrill, architect:—
Withers, Blofield, near Norwich (accepted) £834 0 0

For woodwork in curing premises, Stornoway, Isle of Lewis, N.B., for Mr. J. R. Nutman. Mr. J. W. Cockrill, architect:—

Salmon, Great Yarmouth	£330 0 0
Springall, Great Yarmouth (accepted)	312 0 0

The walls to be executed in concrete by Messrs. Charles Drake & Co. with their patent apparatus.

For the construction of sewerage works at Camden-town, Kentish-town, and Holloway, for the Metropolitan Board of Works. Sir Joseph Bazalgette, engineer:—

Williams, Son, & Wallington	£99,990 0 0
Dickinson	97,009 0 0
Dunmore	86,591 0 0
Kirk & Randall	75,100 0 0
Webster	74,320 0 0
Walls Bros.	73,640 0 0
Crockett	68,634 0 0
Hook & Oldrey	68,530 0 0
Killingback	67,550 0 0
Pearson & Son	65,950 0 0
Nowell & Robson	64,950 0 0
Mowlem & Co.	63,000 0 0
Smith	59,900 0 0
Kellett & Bentley	58,000 0 0
Cook & Co.	53,976 0 0
Rigby (accepted)	52,911 0 0

For the construction of sewerage works from Rotherhithe New-road to Southwark-street, for the Metropolitan Board of Works. Sir Joseph Bazalgette, engineer:—

Dickinson	£79,700 0 0
Williams, Son, & Wallington	78,700 0 0
Crockett	75,752 0 0
Mayo	75,000 0 0
Webster	73,500 0 0
Hook & Oldrey	69,850 0 0
Mowlem & Co.	69,000 0 0
Cooke & Co.	65,000 0 0
Nowell & Robson	65,000 0 0
Kellett & Bentley	59,000 0 0
Pearson & Sons (accepted)	55,500 0 0

For farm buildings at the Temple Farm, Dartford, for Lord Tredegar. Mr. Robert Griggs, architect:—

Waller, Dartford	£1,845 0 0
Crockett	1,675 0 0
Patman & Fotheringham	1,582 0 0
Blake, Gravesend	1,525 0 0
Braid & Co.	1,425 0 0
Sharp & Sons, Dartford (accepted)	1,414 0 0

TO CORRESPONDENTS.

C. J. D.—B. & T.—E. A. P.—D. B.—J. K.—W. S. O.—E. W. C. S.—P. M.—A Builder's Manager.—W. R. C.—R. C. R.—F. H. S.—J. K.—R. H. R.—P Bros.—G. S.—H. G. T.—C. C.—J. M.—J. J.—J. H. J.—D. & D.—H. & H.—T. D. B. & Son.—R. G.—M. & S.—C. C. H.—E. B. S. Bros.—W. S.—B. & T.—G. & S. F.—W. W.—P. L.—T. W. R.—C. S. E.—C. F. H.—J. B.—J. R.—J. W. S. (should send list and amounts).—B. H. T. (shall appear).—J. B. (the manufacture of terra-cotta is carried on in America).—Weekly Subscriber (we cannot attempt to settle private disputes).—Pile Drawing (an old pile-driver asks for Mr. Runnacles's address).—F. W. (willingly).—G. M. (next week).—H. & R. P.—Gas Engineer.

All statements of facts, lists of tenders, &c. must be accompanied by the name and address of the sender, not necessarily for publication.

We are compelled to decline pointing out books and giving addresses.

NOTE.—The responsibility of signed articles, and papers read at public meetings, rests, of course, with the authors.

CHARGES FOR ADVERTISEMENTS.

SITUATIONS VACANT, PARTNERSHIPS, APPRENTICESHIPS TRADE, AND GENERAL ADVERTISEMENTS.
Six lines (about fifty words) or under ..... 4s. 6d.
Each additional line (about ten words) ..... 0s. 6d.
Terms for series of Trade Advertisements, also for Special Advertisements on front page, Competitions, Contracts, Sales by Auction &c. may be obtained on application to the Publisher.

SITUATIONS WANTED.
FOUR Lines (about THIRTY words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

REPLIES TO ADVERTISEMENTS,
Addressed Box ——, Office of "The Builder,"
Cannot be forwarded, but *must* in all cases be *called for*, and the Office Receipt produced.

THE CHARGE FOR A BOX IS AS UNDER:—
For "Situations Wanted" Advertisements ..... 3d. per Week.
For all other Advertisements ..... 6d. per Week.

PREPAYMENT IS ABSOLUTELY NECESSARY.

*** Stamps *must not* be sent, but all small sums should be remitted by Cash in Registered Letter or by Money Order, payable the Post-office, King-street, Covent-garden, W.C. to
DOUGLAS FOURDRINIER, Publisher,
Addressed to No. 46, Catherine-street, W.C.

Advertisements for the current week's issue must reach the office before THREE o'clock p.m. on THURSDAY.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to Advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

TERMS OF SUBSCRIPTION.

"THE BUILDER" is supplied *direct* from the Office to residents in any part of the United Kingdom at the rate of 18s. per annum, *prepaid*. Remittances payable as above.

Best Bath Stone.
WESTWOOD GROUND,
Box Ground, Combe Down,
Corsham Down,
And Farleigh Down.
RANDELL, SAUNDERS, & CO., Limited,
Corsham, Wilts.—[ADVT.]

Bath Stone.
SUMMER DRIED,
STOKE GROUND, and
CORSHAM DOWN,
Supplied in any quantities on the shortest notice.
PICTOR & SONS, Box, Wilts. [Advt.]

Doulting Freestone and Ham Hill Stone of best quality.
Prices, delivered at any part of the United Kingdom, given on application to
CHARLES TRASK,
Norton-sub-Hamdon, Ilminster, Somerset. [ADVT.

Doulting Stone and Ham Hill Stone, of best quality. Prices and Estimates, including delivery to any Station, on application to
STAPLE & HANN, Quarrymen, Stoke-sub-Hamden, Ilminster. Agent, E. CRICKMAY, No. 4, Agar-street, London, W.C. [ADVT.

Asphalte.
Seyssel, Patent Metallic Lava, and White Asphaltes.
M. STODART & CO.
Office:
No. 90, Cannon-street, E.C. [ADVT.]

Asphalte.—The Seyssel and Metallic Lava Asphalte Company (Mr. H. Glenn), Office, 38, Poultry, E.C.—The best and cheapest materials for damp courses, railway arches, warehouse floors, flat roofs, stables, cow-sheds and milk-rooms, granaries, tun-rooms, and terraces. [ADVT.]

J. Sessions & Sons, Docks, Gloucester, Manufacturers of ENAMELLED SLATE and MARBLE CHIMNEY-PIECES, URINALS, &c. WELSH ROOFING SLATES direct from Quarries to any Station in the Kingdom. Manufacturers of Joinery & Mouldings. [ADVT.]

B. J. Hudson & Sons,
MAHOGANY, WAINSCOT, and FANCY WOOD MERCHANTS.
Immense quantities of thoroughly-seasoned Woods, specially adapted for Cabinet and Joinery purposes. Also Veneers of every description always in stock, at lowest possible prices.
WHITFIELD-STREET, LONDON, W., and GREAT PETER-STREET, S.W.

MICHELMORE & REAP,
Manufacturers of
CHARLES COLLINGE'S PATENT
COLLINGE'S PATENT HINGES,
LEVER, SCREW, & BARREL BOLTS,
Self-Acting "FALL DOWN" GATE STOPS,
and IMPROVED GATE FITTINGS of every Description.
36A, BOROUGH ROAD,
Discount to Builders. Illustrated List two stamps. LONDON, S.E.

ZINC ROOFING
FIXED COMPLETE.
F. BRABY & CO.,
ESTABLISHED 1837,
THE MANUFACTURING AGENTS OF THE VIEILLE MONTAGNE CO.
PATENT SOLID UNSOLDERED RIDGE PLATES, FOR ITALIAN OR SQUARE ROLL CAP ZINC ROOFING.
By the adoption of this Method the use of Solder is Entirely Dispensed with, and consequently the Danger incurred by the use of Fire-pots is Avoided. The Cost is Lessened and the Durability Increased. Estimates for Zinc Dormers, Flats, &c.
FITZROY WORKS, 356 TO 360, EUSTON ROAD, LONDON.
ALSO AT DEPTFORD, LIVERPOOL, GLASGOW, and CYPRUS.
Architects, Engineers, and Contractors Supplied with Drawings and Estimates Free of Charge.